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Chinese marine biology	Seawater	Chlorhexidine
Taiwan marine scientists	Rainwater	Collagen

20. ABSTRACT *(Continue on reverse side if necessary and identify by block number)*

This is a quarterly publication presenting articles covering recent developments in Far Eastern (particularly Japanese) scientific research. It is hoped that these reports (which do not constitute part of the scientific literature will prove to be of value to scientists by providing items of interest well in advance of the usual scientific publications. The articles are written primarily by members of the staff of ONR Tokyo

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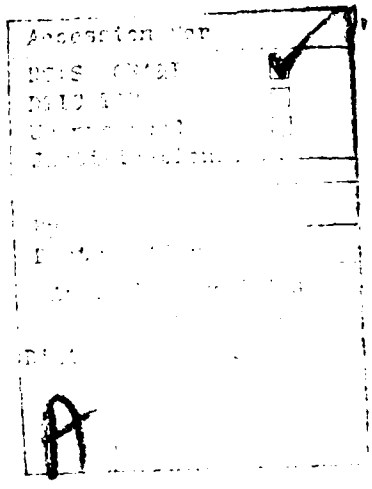
19. (Key Words - cont.)

Streptococcus mutans
Glucosyltransferase
Muramic acid dipeptide
Gingivitis anaerobic bacteria
Prostaglandins
Complement
Lymphokines
Calcium metabolism
Superconducting Josephson junction
High-electron mobility transistor
Gallium arsenide integrated circuit
Metal-semiconductor field effect transistor
Silicon wafers
Optomagnetic discs
Crystal field theory
G-M counters

ANZAAS
Physics
Electronics
Ball lightning
Ions
Nuclear physics
Biophysics
Quantum optics
Particle physics
Geophysics
Electrophysics
Thin films
Ionospheric physics
Theoretical physics
Astronomy
Gemmology
Cosmic rays
Plasma physics

20. (Abstract - cont.)

with certain reports also being contributed by visiting stateside scientists. Occasionally a regional scientist will be invited to submit an article covering his own work, considered to be of special interest.



CONTRIBUTORS

Brian S. Morton is Reader in Marine Biology at the University of Hong Kong. He obtained his Ph.D. from the University of London in 1969 and has spent the last 10 years teaching in Hong Kong. Dr. Morton has published widely on many aspects of marine biology in Hong Kong and southeast Asia, and is author of two books on sea shore ecology. He specializes in the Mollusca and is on the Council of *Unitas Malacologia.*

Francis A. Richards if Professor of Oceanography at the University of Washington. Dr. Richards' research interests in chemical oceanography include analysis of seawater, plankton pigments, oxygen-deficient and sulfide-bearing environments in the ocean, and interrelationships among the branches of oceanography through chemistry. He served on the staff of ONR Tokyo from 1977 to 1979 and again in the summer of 1980.

Jeannine A. Majde is a microbiologist with the Scientific Department of ONR Chicago. She is also an Adjunct Assistant Professor of Microbiology at the Stritch School of Medicine at Loyola University in Chicago. Her specialty areas include immunology, virology, microbial toxins, stress biochemistry, and cell biology; she conducts research in immunopharmacology of infectious diseases.

Young B. Kim, presently on the staff of ONR Tokyo, is on leave from the University of Southern California, where he served as Chairman of the Physics Department from 1975 through 1978. Although Dr. Kim has worked in many different fields, including cosmic rays, high energy, superconductivity, metallurgy, and energy-related research, he is best known for his pioneering research on high-field superconductivity materials in the early 1960s while at Bell Laboratories. He spent the 1966-67 academic year in Japan as a Guggenheim Fellow at the Institute of Solid State Physics, Tokyo University. His present interests are focused primarily on the microscopic aspects of electronic and optoelectronic materials.

Allen L. Robinson, a counseling psychologist, is the founder and director of Tokyo Biofeedback Training Centers. Specializing in educational biofeedback and self-concept-enhancement counseling, he has introduced several thousand students to biofeedback during the past 12 years. He has written a Japanese text book and numerous articles on educational biofeedback and counseling in international journals. He is a member of the Japan Journal of Psychosomatic Medicine editorial staff, the American Biofeedback Society, the Japan Biofeedback Society, the American Personnel and Guidance Association, and Phi Delta Kappa.

Hitoshi Ishikawa, M.D., Chairman of the Department of Psychosomatic Medicine at Tokyo University Branch Hospital, is one of Japan's foremost proponents of the use of psychotherapy and biofeedback in the treatment of psychosomatic illness. Author of many books and numerous articles on biofeedback and psychosomatic medicine, he is presently the director of the Association of Cybernation Therapy, Vice President of the International College of Psychosomatic Medicine, Chairman of the Tokyo Branch of the Japan Psychosomatic Medicine Association, and Chief Editor of the Japanese Journal of Psychosomatic Medicine.

Leon H. Fisher, presently on the staff of ONR Tokyo, is on leave from California State University, Hayward. He completed an eight-year assignment as Dean of Sciences at Hayward, where he is also Professor of Physics. Dr. Fisher has held professorships at New York University and at the University of Illinois, has led research groups at the Lockheed Palo Alto Research Laboratory and the General Telephone and Electronics Laboratory, and has been visiting professor at the University of California, Berkeley, and University of Washington, and the University of Southern California. His specialty is gaseous electronics, and his interests include ionization coefficients in gases, mechanism of electrical breakdown in gases, formation of negative ions, corona discharges, and plasma physics. Dr. Fisher has recently coauthored articles on contact potentials.

Seikoh Sakiyama, Scientific Affairs Specialist of ONR Tokyo, has had considerable industrial experience in laboratory chemistry, electronic instrumentation, and quality control methodology. His interests include computer science, linguistics, and energy technology.

Rudolph J. Marcus served 14 years at the ONR Western Regional Office in Pasadena before becoming Scientific Director of ONR Tokyo in March 1979. Special areas of concern during that time were photochemistry, photophysics, and computer control of chemical experimentation. Dr. Marcus served as founding secretary of the American Chemical Society's Division of Computers in Chemistry (1974-79). His papers on photochemical energy conversion in the 1950s are still being cited.

CONTENTS

COVER: Koala Bear, Lone Pine Sanctuary, Queensland, Australia. Reproduced from the collection of the Australian Tourist Commission, Tokyo, Japan.

FIRST INTERNATIONAL WORKSHOP ON THE MARINE FLORA AND FAUNA OF HONG KONG AND SOUTHERN CHINA

Brian S. Morton

From April 19th to May 9th, 1980 a total of 43 scientists and Asian research students participated in a workshop on the marine flora and fauna of Hong Kong and southern China. The workshop was organized by the Department of Zoology of the University of Hong Kong. Laboratory and research boat facilities were established at the Y.M.C.A. hostel at Wu Kwai Sha, in Tolo harbor, Northeastern New Territories, Hong Kong (Figure 1). Technical and diving assistants were also made available. Wu Kwai Sha is ideal for quiet, academic study because it has no road access.

The participants included 16 scientists from the four local institutions concerned with marine biological research and teaching: the University of Hong Kong, the Chinese University of Hong Kong, Hong Kong Polytechnic, and the Fisheries Research Station of the Agriculture and Fisheries Department of the Hong Kong government. The other delegates represented 13 countries (Australia, Belgium, Bermuda, Canada, Eire, Jamaica, Malaysia, New Zealand, People's Republic of China, Taiwan, Thailand, the United Kingdom, and the United States), and the participation of some was financed by grants from The Commonwealth Foundation, The Intergovernmental Oceanographic Commission of UNESCO, and the Sino-British Fellowship Trust.

Australia and the United States were particularly well represented, but the largest delegation was from the People's Republic of China. The eight Chinese delegates were led by Professor C. K. Tseng, Director of the Institute of Oceanology of Academia Sinica, Tsingtao. Professor Tseng was accompanied by Professor C. Y. Tsi from the same institute. Two delegates from the South China Sea Institute of Oceanology, Guangzhou, Kwangchow, and four delegates from The *Third Institute of Oceanography*, Xiamen, Amoy, also attended.

The research interests of the delegates were wide. Many were taxonomists and the following groups received good, primary coverage: Algae, Kinorhyncha, Ascidiacea, Anthozoa (especially the Scleractinia and Gorgonacea), Echinodermata, Mollusca, Crustacea (Isopoda; Cirripedia; Decapoda) and (marine) Insecta. A second major interest was feeding mechanisms and diet of a number of marine groups, especially benthic fishes and Mollusca. A third major interest was ecology and delegates variously investigated the soft-bottom benthos, coral platforms, mangroves, and rocky shores, plus the ecology of fouled surfaces within Tolo harbor. Two invertebrate physiologists also participated.

The range of research interests was clearly related to what can be reasonably achieved in approximately three weeks of field research, bearing in mind the limited extent of knowledge of the local marine flora and fauna. Because so little basic marine biological research has been undertaken in Hong Kong (especially) and in southern China in general, the specialist taxonomists were able to make good collections, and it is hoped that the results of their studies will broaden our understanding of the local flora and fauna at this ecologically compromised region abutting the Indo-Pacific and Japonic provinces. Studies of dietary habitats in marine animals are a prerequisite to our understanding of marine food chains, and, moreover, can be reasonably undertaken in a short period of time. The ecologists drew upon the knowledge of the specialist taxonomists and were able to complete small, but nevertheless important, surveys. Such studies cannot be comprehensive, but they do stimulate local interest and define areas of importance in this case, the mangroves and coral reefs.

Though the major aim of the workshop was to provide information on Hong Kong's marine life, it was also hoped that scientists from different countries (and disciplines) would undertake joint research. It was further hoped that the specialist would either work with, or at least advise, local and regional young students. This latter aim was, from the first, seen to be very important, and indeed was one of the principal reasons for organizing such a workshop: young scientists in developing countries, unlike their counterparts in the industrialized nations, rarely, if ever, have the opportunity to meet, let alone work with, more eminent colleagues. At least four of the projects undertaken by the delegates from the People's Republic of China were in conjunction with other scientists from Hong Kong and elsewhere.

The workshop was accompanied by an evening seminar series on more general aspects of marine biology. Many of the visitors discussed their individual research interests, or described national marine biological research programs. Of especial interest was a talk, "Marine Biology in China," in which the development of the science was traced from its early beginning to the present day and concluded with China's plans for the future.

The last three days of the workshop were held on Hong Kong island; visits were organized, for those interested, to local institutes engaged in some aspects of marine biological research and/or teaching. The final day of the meeting was devoted to a seminar series in which participants briefly reviewed and discussed the research results obtained at the workshop. This was a valuable indicator of the amount of research that had been achieved by groups of scientists specifically working together in one area. The results of the workshop are to be published as a proceedings with the aid of a grant from the Intergovernmental Oceanographic Commission of UNESCO.

So successful was the meeting that Professor Tseng is pursuing the feasibility of organizing a second workshop, tentatively entitled "The Ecology of the Yellow Sea and Its Coasts," in 1982 in Tsingtao, People's Republic of China.

With few field biologists in Hong Kong and with a marine environment that is rapidly being destroyed by pollution on a large scale, the workshop's principal aim was to provide rapidly (and reasonably cheaply) a large amount of basic information on the intertidal and shallow water marine flora and fauna. Without this workshop much of Hong Kong's marine life would not have been studied. It is my belief that such workshops are a very viable way of quickly studying natural communities, especially where they are threatened, particularly in developing countries, and of promoting local and international interest, education, and cooperation. Too often, field research by scientists from developed countries is undertaken in relative isolation and results obtained are often of personal value only, and not available to the host nation. Fund-awarding bodies may eventually come to share our conclusion that such workshops are of much more general value since the aims they profess and the results they engender are of wider human consequence.

The participants and their fields of research are listed in Appendix I.

APPENDIX I

List of Participants and Fields of Research

– Dr. A. J. Bruce Heron Island Research Station Gladstone, Queensland 4680 Australia	Pontoniid shrimps
– Dr. R. W. George Western Australian Museum Francis Street Perth, Western Australia 6000 Australia	Crustacean taxonomy
– Dr. P. Mather Queensland Museum Gregory Terrace Fortitude Valley Brisbane, Queensland 4006 Australia	Ascidian taxonomy
– Dr. J. Vernon Australian Institute of Marine Science PMB 3 Townsville MSO, Queensland 4810 Australia	Coral taxonomy and ecology

– I. J. Christiaens J. Lipsiuslaan 26 3500 Hasselt Belgium	Limpet taxonomy
– Dr. John C. Markham (Bermuda Biological Station for Research, Inc. St. George's 1-15, Bermuda) Present address: Arch Cape Marine Laboratory Arch Cape, Oregon 97102 U.S.A.	Parasitic isopods
– P. J. B. Scott (visiting scientist from Canada) c/o Department of Zoology The University of Hong Kong Hong Kong	Coral taxonomy and ecology
– Dr. P. Shin Department of Zoology University College Galway Eire	Benthos: polychaete ecology
– Lindsay Bones Department of Zoology The University of Hong Kong Hong Kong	Crab behavior
– K. L. Chan Department of Biology The Chinese University of Hong Kong Hong Kong	Fish feeding
– W. W. Cheng Department of Biology The Chinese University of Hong Kong Hong Kong	Shrimp parasites
– Margaret Cope Department of Zoology The University of Hong Kong Hong Kong	Coral ecology
– Dr. M. J. Daniel Department of Applied Science H. K. Polytechnic Hung Hom, Kowloon Hong Kong	Chiton/limpet physiology
– David Dudgeon Department of Zoology The University of Hong Kong Hong Kong	Mollusca: decorator crabs

Dr. D. S. Hill Department of Zoology The University of Hong Kong Hong Kong	Arthropoda
Vivian Lam Department of Zoology The University of Hong Kong Hong Kong	Cephalopod behaviour
K. Y. Lee Department of Botany The University of Hong Kong Hong Kong	Alga taxonomy
Paul Mak Department of Zoology The University of Hong Kong Hong Kong	Fouling
Dr. B. S. Morton Department of Zoology The University of Hong Kong Hong Kong	Mollusca, intertidal ecology
Dr. D. J. H. Phillips Fisheries Research Station Aberdeen Hong Kong	Heavy metals; coral biology
Dr. G. B. Thompson Fisheries Research Station Aberdeen Hong Kong	Benthos; coral ecology
Dr. W. Y. Tseng Department of Biology The Chinese University of Hong Kong Hong Kong	Mariculture
Dr. R. S. S. Wu Fisheries Research Station 100 A Shek Pai Wan Road Aberdeen, Hong Kong	Energetics
May Yipp Department of Zoology The University of Hong Kong Hong Kong	Mangrove mollusca
Professor I. Goodbody Department of Zoology University of the West Indies Mona, Kingston 7 Jamaica	Ascidian ecology

– K. C. Wong Department of Zoology University of Malaya Kuala Lumpur, Malaysia	Fish feeding
– Dr. B. Foster Department of Zoology The University Auckland New Zealand	Barnacle ecology and taxonomy
– Q. C. Chen South China Sea Institute of Oceanology Guangzhou People's Republic of China	Zooplankton ecology
– Z. G. Huang Third Institute of Oceanography Xiamen, Amoy People's Republic of China	Fouling
– J. X. Jiang Third Institute of Oceanography Xiamen, Amoy People's Republic of China	Benthos ecology
– Y. Q. Fang Third Institute of Oceanography Xiamen, Amoy People's Republic of China	Invertebrate physiology
– Professor C. K. Tseng Institute of Oceanology Tsingtao People's Republic of China	Algal taxonomy
– Professor C. Y. Tsi Institute of Oceanology Tsingtao People's Republic of China	Molluscan taxonomy
– Q. L. Zhou Third Institute of Oceanography Xiamen, Amoy People's Republic of China	Intertidal ecology
– R. L. Zou South China Sea Institute of Oceanology Guangzhou People's Republic of China	Coral taxonomy
– Jane E. Lewis Academia Sinica Institute of Zoology Fisheries Biology Laboratory Nankang, Taipei, Taiwan	Algal taxonomy

– Dr. Hansa Chansang Phuket Marine Biological Centre P.O. Box 60 Phuket Thailand	Mangrove ecology
– Ailsa Clark Department of Zoology British Museum (Natural History) London S. W. 7 England	Echinoderm taxonomy
– Dr. J. D. Taylor Mollusca Section British Museum (Natural History) Cromwell Road London S. W. 7 England	Predatory gastropods
– Dr. Lanna Cheng Scripps Institute of Oceanography A-002 University of California La Jolla, CA 92093 U.S.A.	Marine insects
– Dr. Robert P. Higgins Department of Invertebrate Zoology National Museum of Natural History Smithsonian Institution Washington, D.C. 20560 U.S.A.	Kinorhyncha: Tardigrades
– Dr. Ralph A. Lewin Scripps Institute of Oceanography A-002 University of California La Jolla, CA 92093 U.S.A.	Algae

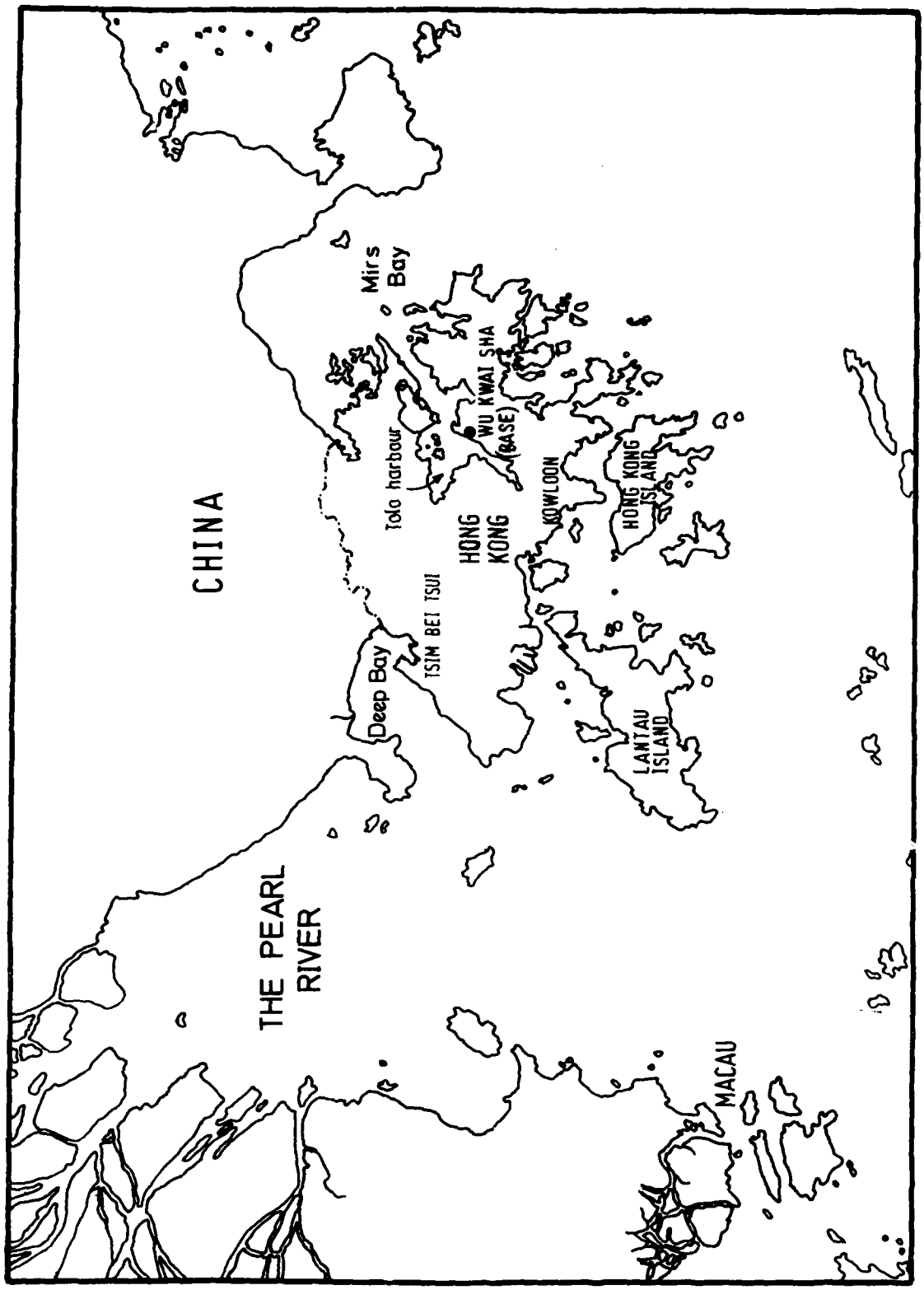


Figure 1. Workshop location and surrounding area

AQUATIC SCIENTISTS IN TAIWAN

Francis A. Richards

The most recent international directory of marine scientists I have seen is the one issued by The Food and Agriculture Organization of the United Nations in 1977. Any such directory quickly becomes out of date, all suffer from omissions, and retirements and recruitments cannot be kept *au courant*.

While attending the Colloquium on Aquatic Environment in Pacific Region held in Taipei in August, 1978, and sponsored by the Scientific Committee on Problems of Environment (SCOPE), Taiwan, it became evident that there is a large number of active and competent aquatic and marine scientists in Taiwan [this Bulletin, *3* (4), 63 (1978)]. Many have wide international reputations, interests, and contacts, and their research activities are up-to-date and productive. As is the case in east Asia, much of the research is closely related to practical matters of aquaculture and fisheries development and, especially important, protection of the environment essential to aquaculture and fisheries [this Bulletin, *5* (1), 11 (1980)].

Using the list of attendees at the SCOPE Colloquium as a starting point, Professor Tsu-Chang Hung of the Institute of Chemistry of Academia Sinica and the Institute of Oceanography of National Taiwan University, Professor Jon-Ching Su of the Institute of Zoology, Academia Sinica, and Professor Ju-Chin Chen, director of the Institute of Oceanography, NTU, developed the following listing of Taiwanese marine and aquatic scientists. It should be an up-to-date addendum to the 1977 FAO list, which does not include Taiwanese. The present list includes over 50 names.

The cooperation of Professors Su, Chen, and Hung in developing the list is gratefully acknowledged.

ACADEMIA SINICA, TAIPEI

- Institute of Biological Chemistry

  Su, Jong-Ching — Biochemistry
  Research Fellow

- Institute of Botany

  Chou, Chang-Hung — Plant ecology
  Research Fellow

- Institute of Chemistry

  Hung, Tsu-Chang — Marine chemistry
  Research Fellow

- Institute of Zoology

  Chang, Kun-Hsiung — Marine zoology
  Director

MINISTRY OF ECONOMIC AFFAIRS, TAIPEI

- Industrial Development Bureau

  Lin, Tsu-Sen — Industrial waste treatment
  Senior Technician

– Water Resources Planning Commission

Hsu, Hong-Hsi Director	Civil engineering

NATIONAL CHENG -KUNG UNIVERSITY, TAINAN

– Department of Environmental Engineering

Kao, Jao-Fuan Professor	Waste water treatment
Tan, Lin-Wu Director	Coastal engineering

NATIONAL CHUNG-HSING UNIVERSITY, TAICHUNG

– Department of Soil Science

Juang, Tzo-Chuan Professor	Soil chemistry

NATIONAL HEALTH ADMINISTRATION, TAIPEI

– Bureau of Environmental Health

Chung, Ching-Yuan Director	Chemical engineering

NATIONAL TAIWAN UNIVERSITY, TAIPEI

– Department of Agricultural Chemistry

Chen, Yuh-Lin Professor	Pesticide chemistry
Lin, Liang-Ping Professor	Microbiology
Su, Jong-Ching Professor	Biochemistry

– Department of Zoology

Chen, Hon-Cheng Professor	Marine zoology
Lin, Yao-Zoen Professor	Marine zoology
Tan, Tien-Hsi Professor	Marine zooiogy

– Institute of Environmental Studies

Yank, Wan-Fa Professor	Civil engineering

– Institute of Oceanography

Chou, Tsu-You Professor (Emeritus)	Physical oceanography
Chen, Ju-Chin Professor (Director)	Marine geochemistry

Yang, Rong-Tszung (Div. Chief) Professor	Fishery biology
Liu, Hsi-Chiang Professor	Fishery biology
Chiang, Young-Meng Professor	Marine botany
Hung, Tsu-Chang (Div. Chief) Professor	Marine chemistry
Liang, Nai-Kuang Professor	Physical oceanography
Tan, Lin-Wu Professor (Adjunct)	Coastal engineering
Chang, Kun-Hsiung Professor (Adjunct)	Fishery biology
Hsu, Min-Ton Professor (Adjunct)	Physical oceanography
Pan, Yuh, Sheng Professor (Adjunct)	Geophysics
Liao, I-Chou Professor (Adjunct)	Marine biology
Chen, Min-Pen Associate Professor	Geophysics
Jeng, Woek-Lih Associate Professor	Marine geochemistry
Feng, Kuang-Lung Associate Professor	Physical oceanography
Liu, C. C. Associate Professor (Adjunct)	Geophysical prospecting
Yao, N. C. Associate Professor (Adjunct)	Physical oceanography
Shyu, C. T. Associate Professor	Marine geophysics

– Institute of Geology

Juan, Veichow Professor	Marine geology
Lee Wang, Chih-Ming Professor	Marine geology
Wang, Chao-Siang Professor	Marine geology

CHINESE PETROLEUM CORP., TAIPEI

Chain, Su-Yen Vice President	Marine geology
Chan, Y. C. General Manager	Marine geology

Chang, Stanley S. L. Chief Geologist	Marine geology
Chiu, H. T. Vice Manager	Marine geology
Huang, Ting-Chang Senior Paleontologist	Marine geology
Pan, Yuh-Sheng Deputy Chief Geologist	Marine geology
Sun, Si-Chin Chief Geologist	Marine geology

NATIONAL TSING-HUA UNIVERSITY, HSINCHU

– Health Physics Section

Weng, Pao-Shan Professor	Health physics

SINOTECH ENGINEERING CONSULTANTS, INC., TAIPEI

Huang, Chen-Yih Senior Technician	Civil engineering

TAIWAN FISHERIES RESEARCH INSTITUTE, KEELUNG

Lee, Tsan-Jan Director	Marine biology
Liao, I-Chiu Senior Scientist	Marine fishery

NATIONAL TAIWAN COLLEGE OF MARINE SCIENCE AND TECHNOLOGY, KEELUNG

– Department of Oceanography

Yin, Fuh Professor (Chairman)	Marine physics
Li, Hsien-Wen Associate Professor	Marine physics

– Department of Aquaculture

Chu, S. H. Professor	Marine biology
Yu, Hsiang-Ping Professor	Marine zoology

– Department of Ocean Engineering

Wei, Norman C. H. Professor	Marine engineering

TAIWAN WATER POLLUTION CONTROL AGENCY, TAICHUNG

Lee, Chin-Dee Director	Civil Engineering
Wang, Sung-Bin Technician	Marine Biology

THE NEW LABORATORIES OF THE GEOCHEMICAL RESEARCH DIVISION, METEOROLOGICAL RESEARCH INSTITUTE, TSUKUBA SCIENCE CITY

Francis A. Richards

A major sign of changing times in Japanese science is the establishment of a whole new city—Tsukuba - dedicated principally to the sciences—natural and social. The government has decided to gather together many of the governmental research institutes and to establish a major new national university within one new community 60 km north of Tokyo. In addition to the new university, some 40 governmental research institutes are now included in the complex. This means that many laboratories formerly scattered about the country, and also those in the Tokyo area, have been relocated. In many cases, it also means that old and much used buildings have been replaced by sparkling new facilities—new, well-equipped, and specifically designed for their scientific objectives. A case in point is the relocation of the Meteorological Research Institute, part of the Japan Meteorological Agency of the Ministry of Transportation.

I reported on the activities of the Geochemical Research Division of the institute in this Bulletin *3* (1), 1-14 (1978), but the changes brought about by moving to the new laboratory are many and an updating is in order. Also, a description of the changes may help one to understand the far-reaching changes current in Japanese science.

The basic objectives of the Geochemistry Research Division are unchanged, and the two main laboratories within the division are still devoted to air chemistry and marine chemistry. The laboratories carry out research on:

- the exchange of chemical substances between atmosphere and ocean,
- the circulation of chemical substances in the atmosphere and ocean,
- radioactive materials in air, fallout, rain water, and sea water,
- the vertical diffusion of radioactive materials near the ocean floor.

The general areas of research have not changed, but the conditions for research differ vastly.

From its inception in 1942 until March 1980, the geochemical laboratory was housed in a one-story wooden building that was old, by Japanese standards, when the laboratory was established. It is not the Japanese custom to paint a wooden building, which is usually considered to have served its purpose after 20 or 30 years, after which it is torn down and a new house is built on the old site. The custom is preserved by the Grand Shrine at Ise, which is torn down every 20 years and replaced by a new, identical building constructed on an alternate site. So, by the time the laboratory moved, the old building was very tired, and it was a little surprising that such high-quality work was produced in it.

To turn to the new laboratories, the main building of the MRI is six stories high, spacious, airy, and modern in every respect. Other new installations of the institute include a meteorological wind tunnel, field experiment annex, buildings for earthquake and gravity observations, radiation observation, upper air measuring instruments, aerosol observations, radiochemistry, cold environment simulation, a wind-wave tunnel building, garages, and a waste treatment plant. The site is dominated by a 213-m-high meteorological observation tower. The tower is designed to withstand 60-m-per-second winds (about 130 miles per hour). Beams, 6 m long, extend out from the tower at seven different levels. The tower was completed in 1975 at a cost of 711.5×10^6 yen (approximately $3,000,000).

The new geochemical laboratories make it possible to carry out specific kinds of research in specialized rooms or areas. Along with the new space, much new equipment has been acquired or, in one case, on order. Some of the most advanced analytical equipment has been made available by grants from the Japan Polar Research Association through the kind offices of Dr. Tetsuya Torii, secretary general of the association and himself a well-known geochemist and long-time friend of the laboratory.

A major grant from Dr. Torii's association is a United Scientific (U.S.A.) Spectrace 440 Fluorescence Spectrometer and System TN-2000 elemental x-ray analysis system (Tracor Northern, U.S.A.). The system is automated and

computerized, and is being used for nondestructive elemental analysis of particulate matter from various sources. Dr. Yukiko Dokiya, a young woman graduate of agricultural chemistry from Tokyo University, hopes to be able to use the instrument for the determination of a wide variety of elements of greater atomic weight than sodium. The spectral display can be altered by changing the energy of the exciting x-rays and the accuracy is corrected by altering the computer program. The machine is so new to the laboratory that its full capabilities have not been realized.

Other equipment in the photometric laboratory is an ANA 40 Fluorospectrophotometer made by the Tokyo Photoelectric Company. It uses a constant exciting wavelength (not x-rays) and the fluorescent wavelength can be selected. It is used for the determination of selenium, amino acids, and protein. A Beckman Accu Lab 10 infrared spectrophotometer is used to study the structure of organic matter dissolved in seawater, as is a new Hitachi 633A High Speed Liquid Chromatograph, which is used in conjunction with an Hitachi 630 Coulometric Monitor. The photometric laboratory also has an Hitachi 124 spectrophotometer and a new Hitachi 170-5A combination atomic absorption spectrophotometer and flame photometer.

A special laboratory is now available for the concentration by distillation of tritium in rainwater and seawater. A water vapor collector, an Aloka $^{3}H/^{14}C$ sampler, is being used to measure tritium in air. It is primarily a cooling system using a dry-ice-ethanol coolant at about -60° C. A rain-water condensing laboratory to be used to follow cesium-137, strontium-90 and plutonium-239 is planned, as is a laboratory for the wet chemical separation of strontium from cesium.

A mass spectrometer room is now equipped with a mass spectrometer-gas chromatograph, which is used to determine chlorinated hydrocarbons and other organic matter in air. A new mass spectrometer is on order from Germany. It will be used to determine lighter atomic species–hydrogen, deuterium, oxygen, nitrogen, and carbon.

Several of the instruments were moved from the old laboratory in Koenji, but they are now housed in a room with a specially-reinforced floor to bear the weight of the shielding materials. The suite includes an Aloka low-background liquid scintillation spectrometer for tritium counting; an Aloka beta counter for strontium-90, a sodium iodide crystal gamma counter and a germanium-lithium spectrometer for determining cesium-137, a carbon-14 counter; an alpha spectrometer system for plutonium, americium, uranium, and thoriun. Their studies include the determination of particulate plutonium; because of the very low concentrations, counting times of several thousand minutes are required. Dr. Sugimura has also built a seagoing radon counter for determinations of vertical diffusion coefficients in the deep sea.

A program of the laboratory is the following of carbon-containing trace gases in rain water. Carbon dioxide is first determined on the sample without combustion; carbon dioxide is again determined after the sample is combusted, giving the total carbon; the organic fraction is determined by subtracting the originally determined carbon dioxide from the total. The organic carbon content of rainwater is small–on the order of 1 milligram per liter. The carbon dioxide is determined using a Shimadzu 4C gas chromatograph. A new Shimadzu 5A gas chromatograph gives the option of flame ionization, electron capture, or thermal conductivity detectors; it is also temperature programmable.

Work on the separation and determination of organic-metal compounds in seawater continues. The compounds are concentrated by freeze drying and then separated and initially characterized by their retention on XAD-2 (an amberlite resin) under different conditions of acid or base treatment. Using a Sephadex separation and an ultraviolet monitor, the organic compounds are now being separated by molecular weight.

A minor problem connected with the move to Tsukuba of concern to chemists is that the water quality in the new city is poor it is high in silica. A Millipore R/Q water purifier, which uses a combination of osmotic separation and ion exchange resins, produces satisfactory laboratory water.

The geochemical laboratory personnel continue their seagoing research, using the *Ryofu Maru* of the Central Metrological Agency as their platform. Recent work has included the occupation of a north-south section along 170° W longitude and an east-west section along 10°N latitude. Observations included dissolved oxygen, ΔO_2 (~ apparent oxygen utilization) nitrate, phosphate, and silica. A deep tongue of silica-rich water that appears to originate in the eastern part of the east-west section seems to be in agreement with GEOSECS (Geochemical Ocean Sections program of the U.S. National Science Foundation) observations and is probably related to silica injections along the East Pacific Rise.

The staff of the laboratory, like the equipment, is partly new, mostly old hands. The director, Dr. Mamoru Ohwada, is new, having come to the laboratory in the spring of 1980 from the Meteorological College. He was trained in

planktonology at the Faculty of Fisheries, Hokkaido University, where he was a student of the well-known Professor Sigeru Motoda. The staff includes five others with doctor's degrees: Katsuhiko Fushimi, Hisayuki Inoue, Katsumi Hirose, Yukiko Dokiya, and Yukio Sugimura. Two younger men are about to complete their doctor of science degrees, Yoshimi Suzuki and Takeshi Sagi. The staff is rounded out by Ms. Teruko Kanazawa, Mr. Yukio Katuragi, Ms. Sadao Kawasaki, and Ms. Sumiko Sakurai.

DENTAL RESEARCH CONFERENCES IN JAPAN

Jeannine A. Majde

Three cities in Japan played host to three dental research conferences during the first two weeks of June. The first meeting, the three-day Eighth International Conference on Oral Biology, took place June 1-3, 1980, in Tokyo. This attracted about 1,400 delegates, 600 from outside Japan. The second meeting, the four-day 58th General Session of the International Association for Dental Research, took place June 5-7, 1980, in Osaka. Over 2,000 delegates attended, purported to be the largest conference attendance in Japan to date. The third meeting, on Implantology and Biomaterials in Stomatology, took place in Kyoto. As I was unable to attend this meeting, I cannot comment further on it. However, I am sure that it, too, was well attended, and benefited from the magnificent organization and warm hospitality that is so characteristic of meetings in Japan.

INTERNATIONAL CONFERENCE ON ORAL BIOLOGY

The theme of the International Conference on Oral Biology was "Oral Disease Prevention--Its Implications and Applications." Presentations were in English with simultaneous translation into Japanese. The opening ceremonies included a Royal Address by HIH Prince Takahito Mikasa on the history of dentistry in Japan. The program was divided into four sessions: preventive measures, diet and nutrition, planning and delivery of dental health care, and evaluation of community dental health programs. The details of the program are appended; it is noteworthy that many of the speakers are from Scandinavia. This report will summarize the highlights of this meeting as perceived by a microbiologist with limited knowledge of oral disease problems.

It is clear from extensive studies on the effects of fluoride that both topical and systemic fluoride are effective in the prevention of dental caries. Water fluoridation at the optimal 1 ppm effects a 50% reduction, while fluoride dentifrices effect a 20-30% reduction. Numerous approaches to fluoride supplementation have been explored, including daily tablets, fluoridated table salt, and fluoride rinses. All have their associated problems. Fluoride appears to work by enhancing remineralization and reducing solubility of the enamel. It may also be effective in the prevention of osteoporosis (bone loss with ageing) and atherosclerosis (fatty deposits in artery walls). The latter is less certain than the former. Fluoride supplementation during pregnancy may benefit bone and tooth formation in the fetus. The only evidence of toxicity of fluoride is fluorosis, or brown mottling of the teeth, which occurs when drinking water fluoride content exceeds 5 ppm.

With respect to control of bacteria, studies now show that oral hygiene measures such as tooth brushing are much less useful than the reduction of sucrose in the diet in the prevention of caries. However, oral hygiene is essential for the reduction of plaque and, most importantly, prevention of gingivitis (gum inflamation). Chronic gingivitis, which leads to alveolar bone loss in the mandible and subsequently to tooth loss, remains the most important oral disease. While dental caries is closely associated with one microorganism, *Streptococcus mutans*, gingivitis is associated with a complex microbial flora, many of which have only recently been isolated in pure culture (in large part because they are very fastidious anaerobes).

Much enthusiasm for a newly-developed topical rinse, chlorhexidine, was evinced. Biweekly rinses with chlorhexidine can eliminate *S. mutans* infections and control microbial growth of all forms above the gingiva. Mechanical cleaning is still required to remove sub-gingival plaque. Chlorhexidine was developed in Scandinavia, I believe, and its status in the U.S. and the rest of the world was not discussed.

Other experimental preventive measures discussed included sucrose substitutes, laser treatment to harden enamel, and immunization against a critical *S. mutans* enzyme.

Considerable work has been done to develop dietary alternatives to sucrose. The cariogenic process performed by *S. mutans* involves the synthesis of an extracellular glucose polymer from sucrose, using the enzyme glucosyltransferase.

The polymer coats the enamel surface and traps acidic bacterial metabolic products which then degrade the enamel. The glucosyltransferase is highly specific for sucrose (the disaccharide glucose-fructose). Japanese workers are investigating some oligosaccharides such as glucosylsucrose, which are inexpensive to produce and provide the same sweet taste as sucrose. Their studies reveal that, while sucrose causes a sub-plaque pH drop to less than 5, the oligosaccharides maintain a pH about 1 log unit higher. The oligosaccharides under study are not degraded by saliva.

The laser studies, also by Japanese workers, represent the most novel approach to caries prevention. A 10 W Nd: YAG laser and optical fiber are used to irradiate the enamel surface for 0.8 sec. This effects a hardening reaction which is highly resistant to caries formation *in vitro* and in experimental studies in rats. One human subject has been treated with the device and experienced no pain. There was no discussion as to whether the change in the enamel was mechanically desirable.

American workers presented their studies in which rats were immunized against the *S. mutans* enzyme glucosyltransferase by various methods. Antibody to the enzyme will prevent caries formation *in vitro*. Immunization by multiple injections into the salivary gland results in 40-70% protection against caries formation in rats. Preliminary studies, using the new adjuvant muramyl acid dipeptide (MDP, the smallest active component of the bacterial peptidoglycan responsible for the adjuvancy of Freund's complete adjuvant), revealed that salivary antibody could be substantially increased, using MDP by the oral route. Injection with MDP increased serum antibody but not secretory antibody. The latter is thought to be much more protective in the oral cavity.

The main body of the conference dealt with community health programs in preventive dentistry which have been developed by various countries. It is clear that such programs in industrialized countries are effective in controlling caries and are generally economical, but that much work remains to be done in the control of periodontal disease.

Abstracts from this meeting are on file at the Office of Naval Research in Tokyo, and selected ones (in English and Japanese) are available from the Director.

INTERNATIONAL ASSOCIATION FOR DENTAL RESEARCH

This conference was more oriented toward basic research than the oral biology meeting and provided a plethora of information on all aspects of dentistry. All presentations were in English, with Japanese translation available at a few symposia. A total of 449 papers were presented in simultaneous oral and poster sessions, along with eight symposia on various topics. The range of topics covered will be apparent from the summary program provided in the appendix. As the oral biology meeting had provided a good overview of the state-of-the-art in dental caries research, I focussed my attention on the microbiology and pathology of periodontal disease.

The microbiology of periodontal disease is a complex area. As mentioned above, many of the organisms are fastidious anaerobes which could not be isolated until anaerobic techniques were greatly improved about ten years ago. Several of the spirochetes still defy cultivation, and it is not certain that all of the less morphologically distinct bacilli have been isolated.

The association of any one organism with a specific form of periodontal disease has been achieved in only one instance, that of *Actinobacillus actinomycetemcomitans* with juvenile localized periodontitis. Elegant studies at the Forsyth Dental Center in Boston have been initiated where all known oral microorganisms, grown in pure culture, are fixed to plastic plates for ELISA determinations of antibody. This group can now routinely screen sera and salivary antibodies in periodontal patients to determine if a specific pattern of antibody formation to oral organisms exists. Several hundred patients have been screened to date, and the only clear-cut association is that stated above. This organism, called Y4 for convenience, has also been associated with juvenile periodontitis by other methods in other laboratories. Numerous workers are isolating endotoxins, peptidoglycans, and secretory products from organisms of the dozen or so genera isolated from patients, and looking at a variety of specific and non-specific inflammatory mechanisms which may be ultimately responsible for driving bone resorption. Equally as complex are the intrinsic and extrinsic factors affecting the health of periodontal tissues.

The gingiva has a very high turnover of collagen, and disturbance of collagen metabolism is apparent in periodontal disease. Periodontal disease fibroblasts make an excess of alpha-1 versus alpha-2 collagen, and other protein synthesis aberrations are being investigated. Different fibroblast populations make different types of collagen, and macrophage

products (like prostaglandin E_2 or PGE_2) can select alpha-1 producers *in vitro*. Other extrinsic factors (from blood or extracellular fluid) such as the first component of complement will alter collagen metabolism. These substances may derive from local inflammatory reactions, as may a factor present in the supernatant of lymphocyte cultures stimulated with phytomitogens which selectively inhibits collagen synthesis. Presumably, these inflammatory factors arise from specific and non-specific responses to resident microbes, but tissue antigens have not been excluded.

The event in periodontal disease which leads to tooth loss is the destruction of mandibular alveolar bone. A procedure for studying bone resorption *in vitro*, using fetal rat long bones in organ culture with ^{45}Ca, has permitted analysis of calcium metabolism in the presence of modulators of inflammation such as complement and PGE_2. Complement activates membrane phospholipase, which releases arachidonate, the substrate for protaglandin synthesis. In cultures supplemented with arachidonate, release of ^{45}Ca is stimulated; prostaglandin synthetase inhibitors such as indomethacin black collagenase which potentiates bone destruction. Complement plus some undefined antibody will inhibit bone protein synthesis by a mechanism which is not affected by indomethacin. A number of microbial products as well as freeze-dried inflamed gingiva stimulate prostaglandin release; endotoxin and PGE_2 are synergistic, as are endotoxin and the lymphokine osteoclast activating factor (OAF). Calcium release is also affected by hormones, dihydroxy D_3 being the most potent, parathormone next, and thyroid hormone next, relative to PGE_2. Salivary epidermal growth factor is also active in bone cultures, as is prostacyclin induced by complement. The synthetic adjuvant MDP was observed to stimulate prostaglandin and collagenase secretion by macrophages.

It is apparent that mechanisms driving periodontal disease are poorly understood, but that some profitable approaches have been developed.

Selected abstracts (in English) are available from the Director of the Office of Naval Research in Tokyo. They are also available as Vol. 59, Special Issue B, of the Journal of Dental Research.

APPENDIX 1

PAPERS GIVEN AT THE 8TH INTERNATIONAL CONFERENCE ON ORAL BIOLOGY

– Y. Ericsson Karolinska Institutet Stockholm, Sweden	Fluorides: State of the Art Bacterial Control: State of the Art
– J. Ainamo University of Helsinki Helsinki, Finland	Bacterial Control: State of the Art
– S. Takuma Department of Dentistry Faculty of Dentistry Tokyo Dental College 9-18, Misaki-cho 2-chome Chiyoda-ku, Tokyo 101 Japan	Demineralization and Remineralization of Tooth Substance, Ultrastructural Basis for Caries Prevention
– T. Yamada, K. Igarashi, and M. Mitsudomi Department of Dentistry Faculty of Dentistry Tohoku University 4-1, Seiryo-cho Sendai, Miyagi 980 Japan	Evaluation of Cariogenicity by a New Method to Measure pH under Human Dental Plaque *in Situ*
– M. A. Taubman J. L. Ebersosle, D. J. Smith, and D. C. Reger Forsythe Dental Center Boston, MA U.S.A.	The Immunochemical Approach to Dental Caries Prevention: Adjuvant
– H. Yamamoto and K. Sato Department of Dentistry Faculty of Dentistry Tohoku University 4-1, Seiryo-cho Sendai, Miyagi 980 Japan	Prevention of Dental Caries by Nd: YAG Laser Irradiation
– D. Bratthall University of Lund Malmo, Sweden	Selection for Prevention of High Caries Risk Groups

H. S. Horowitz National Institute of Dental Research Bethesda, Md U.S.A.	Combinations of Caries Preventive Agents and Procedures
– L. J. Okholm Danish Consumers Cooperative Society Copenhagen, Denmark	Dietary Risk Factors: Industry's Responsibility
– M. C. Alfano Fairleigh Dickinson University New Jersey, NJ U.S.A.	Diet and Nutrition in the Etiology and Prevention of Oral Disease
– A. Sheiham London Hospital Medical College London, England	Educating the Public about Sugar
– S. A. Miller Food and Drug Administration Washington, DC U.S.A.	The Control of Non-Mortal Hazard: The Limits of Government
– M. K. Nikias, N. Budner, M. Glassman, and L. Turgeon Columbia University New York, NY U.S.A.	Compliance with Preventive Oral Home Care Regimens
– O. Sakai and K. Horii Department of Dentistry Faculty of Dentistry Niigata University 5274, Gakko-machi-dori 2-ban-cho Niigata, Niigata 951 Japan	Spreading the Effect of Caries Prevention for School Children
– J. A. Coombs, J. B. Silversin, and M. E. Drolette Harvard University Boston, MA U.S.A.	Adoption of Dental Preventive Measures in United States School
– M. A. Lennon, D. M. O'Mullane, M. C. Downer, and P. J. Holloway University of Manchester Manchester, England, and – G. O. Taylor Tameside Area Health Authority England	The Influence of Field Trials (Community Clinical Trials) on Public Health Decisions in Preventive Dentistry
– J. Hefferen, W. A. Ayer, and H. Gift American Dental Association Chicago, IL U.S.A.	Re-examination of the Original Evanston-Oak Park Fluoridation Study Participants after Thirty Years: Preliminary Report

- L. A. Heløe
  University of Oslo
  Oslo, Norway

  The Short and Long-Term Effect of Organized Public Dental Programs. An Evaluation Based on Cross-Sectional and Longitudinal Data

- A. J. Bonito
  Research Triangle Institute
  Research Triangle Park, NC
  U.S.A., and
- L. K. Cohen
  National Institute of Dental Research
  Bethesda, MD
  U.S.A., and
- D. E. Barmes
  World Health Organization
  Geneva, Switzerland

  Characteristics of Preventively Oriented Dentists: A Six-Nation Comparative Study

- P. B. V. Hunter, M. J. Hollis, and H. B. Drinnan
  Department of Health
  Wellington
  New Zealand

  The Impact of the WHO/DD International Collaborative Study of Dental Manpower Systems on the New Zealand School Dental Service

APPENDIX II

PROGRAM OF THE 58TH GENERAL SESSION OF THE INTERNATIONAL ASSOCIATION FOR DENTAL RESEARCH

The program consisted of eight symposia:

Fluorides for Everyone
Immune Modulation of Connective Tissue Metabolism
- Pulp Response to Newly Developed Restorative Procedures
- Facial Esthetics and Behavior
- Normal and Abnormal Craniofacial Development
- Sensory Mechanisms of the Dental Pulp
- Immune Mechanisms in the Oral Cavity
- The Role of Fluoride in Tooth Formation and Caries

The following paper sessions were presented:

- Neuroscience I, Motor Systems
- Neuroscience II, Sensory Systems
- Microbiology/Immunology I, General
- Microbiology/Immunology II, Immunology
- Dental Materials I, Porcelain Fused to Metal and Cements
- Dental Materials II, Prosthetic Materials and Sealants
- Dental Materials III, Composites
- Dental Materials IV, Amalgam
- Dental Materials V, Alloys and Implants
- Dental Materials VI, General
- Mineralized Tissue I, Biochemistry
- Mineralized Tissue II, Histology and Ultrastructure
- Mineralized Tissue III, Chemistry and Physics
- Craniofacial Biology I, Congenital Defects
- Craniofacial Biology II, Orthodontics
- Craniofacial Biology III, Basic and Genetic Studies
- Periodontal Research I, Pharmacotherapeutics and Microbiology
- Periodontal Research II, Experimental Pathology and Biochemistry
- Salivary Research: Physiology, Biochemistry
- Cariology I, Preventive Dentistry
- Cariology II, Biochemistry, Nutrition
- Pulp Biology I, Histology, Physiology, and Biochemistry of the Pulp
- Pulp Biology II, General
- Oral Pathology
- Prosthodontics I, Temporomandibular Joint (Restorative)
- Prosthodontics II, Restorative
- Behavioral Sciences, General
- Pathology and Oral Surgery, General
- Pharmacology, Therapeutics, and Toxicology

The poster presentations were devoted to:

- Mineralized Tissue
- Pharmacology, Therapeutics, and Toxicology
- Behavioral Sciences
- Dental Materials, Miscellaneous
- Cariology, General
- Craniofacial Biology and Neuroscience
- Microbiology/Immunology I, General
- Microbiology/Immunology II, Cell Biology, Enzymology
- Pulp Biology: Histology, Physiology, and Biology of the Pulp
- Salivary Research
- Pathology, Experimental Pathology
- Periodontal Research
- Prosthodontics

BIOFEEDBACK RESEARCH IN JAPAN

Hiroshi Ishikawa and Allen L. Robinson

WHAT IS BIOFEEDBACK?

Essential to the understanding of biofeedback is the concept of feedback itself. In the words of mathematician Norbert Wiener, who has written extensively on feedback, "Feedback is a method of controlling a system by reinserting into it the results of its past performance." Every human, in fact, possibly every living thing, uses some form of feedback in the process of living. Humans use feedback in many ways in everyday life. A man shaving, or a woman applying lipstick, without the visual feedback which a mirror gives would find the task highly difficult. Just the act of walking down a busy street involves a tremendous amount of feedback. The mind efficiently processes all incoming feedback stimuli to keep one from bumping into everybody met on the street. Hearing is another good example of feedback essential in the performance of many of the day-to-day communication tasks often taken for granted. Music teachers claim that "a good ear" is one of the most important prerequisites to becoming an accomplished musician or vocalist. The simple task of talking would be nearly impossible without the audio feedback which the ears provide. Without this feedback, one would not know whether one were whispering or shouting. That is precisely the problem which people face who have become hard of hearing: they often cause those around them embarrassment and concern by shouting their words, assuming that their listeners, too, are having trouble hearing what is said. An electronic hearing aid, in this situation, could be considered a feedback instrument, as it does feed back information on speech qualities to the user.

Consider the situation of a golfer engaged in the task of learning to putt. Imagine that he hits his first ball too far to the left and a bit beyond the hole. His eyes will provide the essential feedback information so that he can correct his next putt, making it a little bit softer and a bit more to the right. In time, using this visual feedback, he learns to hit the ball just right so that he makes successful putts most of the time. Were one to blindfold this golfer and ask him to do the same task without visual feedback, he would find it virtually impossible. One can think of many other examples of feedback in everyday use.

Now, what does adding *bio* to feedback imply? Biofeedback, simply speaking, is the feedback of biological, physiological data about the functioning of the body to the mind that is controlling that body.

The purpose of biofeedback training is to allow a person to learn to control various functions of the body which are normally beyond voluntary control. As an example, many students of biofeedback are now learning to slow down or speed up their own brainwaves in order to produce a more efficient state of mind to accomplish whatever task they may be working on. Some doctors are teaching their patients to exert control over the autonomic nervous system which controls body temperature in order to warm or cool various parts of the body. It has been found that, by warming the hands and cooling the forehead, patients are able to relieve migraine headaches without resorting to medication of any kind. It has been well documented that Tibetan monks, living in unheated caves in the mountains, are able to endure long, cold winters in a single cloth wrap that would be comfortable to the average person on a hot summer's day. In below-zero weather, they are able to raise the temperature of a hand to melt snow for drinking water.

Years ago, Western scholars would shake their heads in dubious amazement at such feats and considered them outside of the scientific realm. Today, however, students in university laboratories around the world are learning to duplicate some of these feats with the aid of modern electronic instrumentation. Self-control of body temperature, with the help of a temperature biofeedback instrument, is a simple and easily-learned skill today.

Autogenic training is one of the ways science has found to exert a significant amount of control over that part of the autonomic nervous system which controls the body's temperature. This is a fine example of the use of imagery to visualize so vividly that a hand or foot is becoming warm, that the subconscious, uncritical, unanalytical faculties of the mind accept the visualization as fact, and elicit the necessary autonomic responses necessary to produce the warmth.

This simply involves, of course, increased blood flow to the area of the body being concentrated upon in order to warm it. The reason this happens is in part because the nerves which carry the message of imagined warmth also effect this warmth.

The average person, however, without the aid of biofeedback information, is inclined to doubt one's abilities in autogenic-type training and to give up in disgust before any physical change in warmth is cognitively detected, thus incorrectly concluding that self-control of body temperature is impossible for oneself. This is where biofeedback instrumentation proves of value. By giving accurate second-by-second information about the actual temperature of the hand or foot one is attempting to warm mentally, one has proof of the fact that there is really a change of temperature taking place. This provides the very important element of motivation to continue, and eventually to succeed.

So again, in simplest terms, biofeedback is a method of giving accurate, up-to-the-minute "news" electronically about a biological function of the body to the brain which is controlling that body, in order that the person utilizing the biofeedback instrument can, with practice, learn a degree of control over that biological function.

Biofeedback instruments vary considerably in size, complexity and price. A good quality, computerized laboratory EEG or EMG (see definitions below) biofeedback instrument can easily cost over $10,000 and is so complicated that it needs a team of highly-trained experts to operate it. On the other hand, some instruments such as GSR or temperature biofeedback instruments made for home or school use can be had for as little as $100 or so. These inexpensive, easy-to-use instruments can prove to be just as effective in relaxation and stress-alleviation training as the multithousand dollar instruments.

In order to give an idea of the variety of biofeedback training that is going on today, it might be well to discuss briefly some of the various biofeedback instruments that are in use in hospitals and laboratories around the world.

One of the very first biofeedback instruments that psychologists and biofeedback researchers began to work with was an adaptation of the electroencephalograph (EEG). For biofeedback purposes, the electroencephalograph had to be modified so that one could observe his own brain wave activity in order to attempt to exert some control over it. Sound circuitry was added and the subject doing the EEG biofeedback training was rewarded with a certain sound whenever a sufficiently strong brain wave rhythm of the frequency to be strengthened was produced.

Dr. Joe Kamiya of the Langley Porter Neuropsychiatric Institute in San Francisco is credited with being the first to consider the idea that humans might be able to control their own brain wave activity measurably and willfully. He was conducting research on the brain wave activity of sleep at the Sleep School of the University of Chicago in 1958, hiring students on a part-time basis to sleep in the laboratory while connected to an electroencephalograph. Kamiya and his assistants studied the brain wave patterns of the sleeping students, and gathered important information about human sleep cycles, as well as neurological data concerning insomnia and other sleep disorders. Some students were able to overcome the discomfort and distractions of the myriad of wires and sensors attached to their heads, and, adapting themselves quickly to the EEG-monitored conditions of sleeping, found it easier to enter sleep than others. Kamiya decided to try an experiment with one of these highly adaptable students; with a portable EEG instrument in a separate, semi-darkened room, he asked the student to guess, each time a bell was rung, whether or not he was producing a high amount of a pre-sleep brain wave activity of a type designated as "alpha." He was to signal "yes" if he thought he was producing a high amount of alpha brain wave activity, and "no" if he thought he was not. The first day, the students accurately guessed his alpha brain wave states 50% of the time, which could be attributed to pure chance. On the second day, however, he was able to identify his alpha brain wave states 65% of the time; on the third day, 85% of the time, and on the fourth day he guessed right 400 times in a row for a score of 100%. This experiment was repeated with ten other subjects and proved that humans can not only learn to identify their brain wave states, but can learn to actually control them. As this news spread through the scientific community, interest in brain wave training spread through the United States and the rest of the world.

The next problem to consider was how to teach this ability to exert control over the brain waves in the quickest and most efficient manner. The answer Kamiya found was biofeedback. He constructed an instrument that would convert the occurrence of alpha brain wave activity into a sound. Each time a subject produced a sufficient amount of alpha brain wave activity, a tone would reward him with immediate confirmation of his success. When he stopped producing alpha brain wave activity, the tone would also stop.

As brain wave biofeedback became more and more popular, psychologists and doctors began to explore other possible ways biofeedback might be used to monitor biological functions of the body. It is well known that a person's heart beats faster when excited or frightened. Were an instrument devised to amplify the sound of the heart beat, could a person use this information to learn control over that organ too? The answer was "yes," and heart-rate and blood-pressure biofeedback came into being. Another instrument was devised to listen to the sound of respiration and this instrument is being used today at the City of Hope Hospital near Los Angeles to teach patients to breathe more smoothly and to overcome various respiratory illnesses such as asthma. A similar instrument is also being used at the Tokyo University Branch Hospital in the treatment of breathing disorders.

The biofeedback instrument that is getting the most attention from the medical field these days is the electromyograph (EMG). This instrument translates muscular tension into an audible tone so that the user can learn to relax or tense any particular muscle or muscle group. EMG is proving to be of great help in the treatment of various muscular-cramp-type illnesses such as writer's cramp, spasmodic torticollis, and tension headaches, in hospitals around the world. At the Tokyo University Branch Hospital, EMG biofeedback and stress reduction relaxation pschyotherapy are being combined to treat these and other psychosomatic diseases of the nervous system (Ishikawa 1977). In the treatment of tension headaches, EMG sensors are attached to the patient's forehead in order to monitor the amount of tension in the frontalis muscles. By learning to relax these frontalis muscles, the patient can usually gain willful control over this type of headache. In the treatment of writer's cramp, EMG sensors are applied directly over those muscles involved in writing, and the patient learns to relax these muscles while writing. It seems that almost any muscular problem can be alleviated through the proper use of EMG biofeedback training.

However, should one want to try EMG biofeedback training on one's own in one's own home, the situation is much like that of brain wave biofeedback instrumentation. It is expensive and should be done under qualified supervision. Most of the reputable biofeedback instrument companies producing EMG instruments prefer not to sell them directly to an untrained user. They prefer to sell their instruments to the physician, psychiatrist, or other responsible professional therapist so that they can be assured that patients or subjects are using EMG under trained supervision.

In the biofeedback training methods which have been discussed so far, the training efforts have been directed toward relieving mental stress and tension indirectly by controlling some organ or muscle of the body or, in the case of EEG biofeedback, to speed up or slow down the electrical activity within the brain and thus quiet the emotions or the mind.

In the case of galvanic skin response (GSR) biofeedback, information which pertains directly to changes within the two branches of the autonomic nervous system is monitored. The conductivity of the skin changes quantitatively with emotion experienced by the subject. This fact has been utilized in the lie detector, where emotions generated by questions and answers are reflected by changes in skin conductivity. The technique measures self-generated emotional changes equally well.

When one takes a simultaneous recording of EEG and GSR of a subject or patient, one usually notices that, as the galvanic skin resistance increases, there is a corresponding increase in alpha brain wave activity. GSR biofeedback is one of the safest, easiest to learn, and most economical of all types of biofeedback instrumentation available today. It is, thus, the natural choice of many relaxation therapists to introduce a patient or client to biofeedback relaxation training.

WHY COUPLE AUTOGENIC TRAINING WITH BIOFEEDBACK?

The purist biofeedback researcher will argue that biofeedback needs no augmentation. Nor does the autogenic training purist feel any need for biofeedback monitoring of the autogenic process. However, increasing numbers of practical users of both modalities are recognizing that the two techniques complement each other.

Autogenic training is in itself a very valid approach to deep relaxation and to coping with stress-related physical and psychological illnesses. But, by adding the element of biofeedback monitoring to the autogenic training process, results usually come quicker and the trainee is usually more highly motivated to continue training.

The same thing can be said of biofeedback training. Adding a mind-quieting process to the biofeedback training speeds the process of control. In pure biofeedback training, the subject is attached to an instrument and simply told to find his own way of mentally turning on or quieting the instrument. The instrument gives a signal to advise the user of any progress, but it is quite difficult to will the instrument to produce a sound or to become quiet without some type of

methodology. When left to their own resources, many subjects of biofeedback research report that they were able to learn control of the sound by mentally visualizing some pleasant scene or situation.

Purists in autogenic training are quick to point out that it has been practiced successfully for some eighty years now without biofeedback monitoring, so what is the need to add this crutch now? The same thing might be said for zazen, which has been practiced in Japan for centuries without any need for electronic help. However, the process of learning zazen is uaually considered to take many years of diligent, unquestioning practice with a teacher. Biofeedback instrumentation removes the unquestioning part, giving up-to-the-second information about the learner's progress and should invariably speed progress in learning. One zazen training society in Tokyo is now using a GSR BioMonitor® in training new members, possibly a new trend.

As autogenic training complements biofeedback training so nicely, let us take a brief look at how it came about, what it does, and how one might benefit from its use.

AUTOGENIC TRAINING

Autogenic training was pioneered in Europe in the early 1900s and is still today one of Europe's more popular methods of deep relaxation, stress control, and treatment of psychosomatic illnesses. It grew out of experiments by a German brain physiologist, Dr. Oskar Vogt, to teach his patients self-hypnosis. Vogt, like many other doctors of that day, was very impressed with, and interested in, the beneficial effects that hypnosis was proving to have in the field of medicine. He painstakingly compiled data on the various sensations and feelings reported by his patients as they come out of the hypnotic state. Vogt found that many of them reported very similar feelings of warmth and heaviness in their limbs as they entered hypnosis and their tensions melted away. Many reported feeling "calm, peaceful, and at ease." Some reported that this feeling of heaviness and/or warmth started at their toes and gradually worked upward as they drifted deeper into hypnosis, until finally their whole body seemed to be engulfed in a warm, heavy, quiet relaxation. Many reported that they found it easy to concentrate on the instructions the doctor was giving them, even though they were aware of many outside noises and voices. Extraneous sounds seemed unimportant compared to the instructions the doctor was giving them and so they simply chose to ignore outside sounds.

Dr. Vogt, looking for simpler, easier, and faster ways to teach his patients self-hypnosis so that they could continue their therapeutic treatments by themselves in their own homes, decided to weave these reported feelings and bodily sensations into a systematic system of simple, mental exercises, to see if a patient's imagination could not produce a satisfactory hypnotic state. He was delighted to find that it not only worked, but worked very well. His results were so encouraging that he began to use this "imagined self-hypnosis" with all his patients, and a majority of them responded very well. He found that the deep states of relaxation the patients achieved from this method did indeed speed the recovery from many and varied illnesses of that day. He named his new method "prophylactic rest-hypnosis," and gained some fame in its use.

In 1905, a German psychiatrist, Dr. Johannes Schultz, became interested in Vogt's prophylactic rest-hypnosis and tried it on his patients. He, too, succeeded in producing very satisfactory states of hypnosis in patients who would simply imagine that they were feeling the effects and sensations of hypnosis. Schultz found this imagined self-hypnosis, which he shortly after renamed *autogenic training*, to be fully as effective as, and more easily accomplished than, the older, slower, classic methods of hypnotic induction.

Schultz's younger colleague, Dr. Wolfgang Luthe, has carried on Schultz's work, refining and improving it even more, and is now teaching in Montreal, Canada, where he is the medical director of The International Institute of Stress–Center for Applied Studies. He is also scientific director of The Oskar Vogt Institute, the "mecca" of the autogenic training movement in Japan, located at the Medical School of Kyushu University.

Technically, the success of autogenic training can be explained by the psychophysiological principle, which states, in part, that every change in the mental/emotional state of the mind is accompanied by an appropriate change in the physiological state of the body. And this is what the biofeedback instrument is measuring. When one can will this proces, psychosomatic self-regulation is possible.

Most of the work in animal experimental biofeedback research in Japan is being carried out at Sophia University's Department of Psychology by Drs. Hisashi Hirai and Fumio Yagi. In one of their better known experiments on the effects of feedback-mode upon instrumental learning of heart-rate changes, 20 rats were deeply curarized and maintained by artificial respiration. Ten rats each were randomly assigned to two feedback-mode groups; a 1RR Group and a 5RR Group. In the 1RR Group, as the name indicates, subject rats (Ss) were presented continuous feedback on the basis of a one-heart-beat unit, while in the 5RR Group, Ss were given feedback on heart rate changes on the basis of a five-beat unit. In each group, half of the Ss were randomly rewarded for increases in heart-rate, and the other half of the Ss were randomly rewarded for decreases. The trial of instrumental learning of heart rate changes was started by the onset of a 200 Hz, 82 dB, tone. The training of 300 trials was carried out on a fixed schedule with a mean inter-trial interval of 30 seconds. Heart-rate and blood pressure responses, recorded during a test trial in which a tone was presented for five seconds during every tenth trial, were analyzed.

Each group of Ss learned to increase or decrease their heart-rates, respectively, in order to escape and/or avoid the mild electric shocks, consisting of a 0.2 second rectangular pulse of 0.3 mA, which were delivered to the Ss' tail. Differences of the changes for the opposite directions were significant in the 1RR Group ($F = 5.37$, $df = 1/56$, $p < .025$) and in the 5RR Group ($F = 59.43$, $df = 1/56$, $p < .005$). In the case of heart-rate deceleration, the difference in heart-rate changes between the 1RR Group and the 5RR Group was not significant. On the other hand, the 5RR Group showed a more highly significant heart rate acceleration than did the 1RR Group ($F = 14.11$, $df = 1/56$, $p < .005$).

Thus, it is suggested that feedback-mode is an important factor to determine the degree of heart-rate change in this kind of learning, and that the acquisition of heart-rate speeding and slowing appears to involve different psychophysiological mechanisms (Yagi 1975).

Much of the human experimental research in Japan is being carried out by Drs. Miyata and Inamori of Kwansei Gakuin University's Department of Psychology, Hama, Kawamura, Matsuyama and Mine of Doshisha University's Department of Psychology, and Suzuki of Kyoto Prefectural University of Medicine's Department of Physiology. One of their studies involved the effects of false heart-rate biofeedback on 40 male subjects in an experiment of preference for various photographic slides.

Results showed that Ss in these groups who had an opportunity of self-persuasion during a second presentation of the slides evaluated those slides to which false heart-rate-increase information was given as being more attractive than those slides to which false heart-rate-constant information was given. These results were not due to the familiarity of those slides presented longer or to actual heart-rate changes (Inamori 1975).

Another report involves two experiments in the voluntary control of skin temperature and the relationship respiration may have in this control. In the first experiment, a group of 18 college students (male and female) were asked to change the skin temperature of their dominant hand. They subsequently learned to raise and lower digital temperature significantly. In measuring the students' respiration rate, no significant effect in analysis of variance was found. No clear relationship between skin temperature and respiration as a whole was found. However, in some aspects, the respiration factor could not be ignored. When the respiration rates before and after the sudden increase of skin temperature were compared, there was no difference. However, at the sudden decrease in temperature, just before the peak, the respiration rate increased and then gradually decreased as the temperature decreased. The subjects whose respiration amplitude in the training period became larger than in the rest period proved to be more successful in skin temperature increases and decreases. Thus, the increased amplitude of respiration seems to have some positive effect in skin temperature control.

In the second experiment, 11 male children were instructed to change the skin temperature of their hands to make one hand warm and the other cold. No relationship between skin temperature and respiration was found as a whole. However, when the temperature difference between both hands suddenly became large, the respiration rate increased in many cases. And when the difference became small, the respiration rate decreased. These results seem to indicate an influence of respiration over skin temperature control through some as yet unknown complex mechanism (Hama 1975).

Biofeedback and behavioral approaches are being used at the University of Tokyo Branch Hospital in the treatment of various psychosomatic diseases such as hypertension, bronchial asthma, tension headaches, and nervous system disorders such as writer's cramp and spasmodic torticollis.

In a number of studies conducted on hypertensive patients from 17 to 62 years of age, from 1975 to 1979, a clear relationship between respiration and blood pressure emerged (Ishikawa 1975, Kikuchi 1979). Hypertensives and neurotics who suffered from depression, anxiety, or hysteria were studied and found to have abnormal respiratory patterns. In the case of patients with anxiety neurosis, hyperventilation syndrome, and hypertension, an improvement in respiration pattern invariably resulted in a significant decrease in subjective complaints. Unfortunately, depressive and hysterical patients who showed abnormal egogram patterns proved to be unresponsive to respiratory training.

As a result of data gathered from several years of studies of hypertensive and neurotic patients, it appears that as autonomic functions related to the circulatory system have been found to be influenced by respiration, and as respiration is in turn influenced by emotion, improved respiratory control is usually accompanied by the simultaneous control of autonomic function and emotion (Ishikawa 1977, Kikuchi 1979).

Patients with hypertension also showed more pronounced responses to minor exertions such as holding the breath, deep breathing and mental calculations than did normal control groups. This seems to indicate an instability of the cardiovascular system in hypertensives (Kikuchi 1976). Both Kikuchi and Kezuka report that in studies in which true and false biofeedback information was given hypertensives, the lowering of systolic blood pressure by means of the true biofeedback information was substantially greater than that of the false biofeedback information (Kezuka 1976, 1978, Kikuchi 1978).

In many studies of hypertensives, both direct digital biofeedback using a blood pressure recorder and indirect influencing of blood pressure by providing a visual analogue biofeedback of respiratory patterns on a cathode-ray tube were used. While direct digital blood pressure biofeedback enabled patients to exert a lowering influence on their blood pressure, the effects were not found to be long term. The teaching of improved breathing patterns, utilizing biofeedback information on a cathode-ray tube monitor, however, seems to result in a long-term lowering effect once the modification of the respiratory pattern from shallow chest breathing to abdominal breathing is established. (Ishikawa 1977).

In 1977, Kezuka and Ishikawa tested Feldmann's Respiratory Resistance Biofeedback Technique and Tiep's Respiratory Sound Biofeedback Technique on six asthmatic patients and obtained positive results once the patients were motivated to succeed. In the utilization of respiratory resistance biofeedback, it was found that simply telling the patient "Try to stop the sound of the device so that you can breathe comfortably," was not sufficient. It was necessary for Japanese patients to understand the function of the device and become familiar enough with it to be able to operate it themselves before much success was noted. Therefore, the patients were instructed "Make use of this device so that you can see your own respiratory resistance at 7 cm H_2O/L/sec." When such elements of cognition were added to the instructions, the patients became better motivated and good results were obtained. It was also found necessary to have the patients breathe quietly and slowly from the time of setting the operant level, so that, the respiratory resistance value was not influenced by the fluctuation of total lung volume. It was decided that, in future studies, total lung volume will be measured in parallel with respiratory resistance value in order to study to what extent the increase in total lung volume effects an improvement of respiratory resistance value in this biofeedback technique (Kezuka 1977).

At the 4th Congress of The International College of Psychosomatic Medicine, Morita, Ishikawa, and Morishita reported their success in the integration of transactional analysis and EMG biofeedback in the treatment of 108 neuropsychosomatic out-patients who received weekly 30-minute EMG biofeedback training sessions. As the majority of patients were skeptical at first of the relation between mental factors and psychosomatic symptoms, which is common with many neuropsychosomatic patients, they were given treatments centered on physical aspects, based on biofeedback processes in the initial stage. In the course of biofeedback treatments, an egogram check list in the form of questionnaire sheets, devised by faculty member Kouichi Iwai, enabled even those patients who were unfamiliar with transactional analysis processes to make use of egograms and to yield objective data. The egostate was subdivided into father-oriented (CPs) and mother-oriented (NPs). When the mean egogram value of 121 healthy subjects was compared with that of the 108 outpatients, a noticeable difference was found in personality conflict AC (adaptive child) scores, the patient group showing decisively higher AC scores than the healthy control group.

It was found that, in the treatment of psychosomatic diseases, instructions of self-control must be given both in the mental phase and in the physical phase. The questionnaire-type egogram not only allowed the unbalance in the ego state to be evaluated objectively, but also allowed the behavior modifications in the course of psychosomatic treatment to be objectively observed through changes in the egogram. In the course of biofeedback treatment, even those patients who did not at first accept the psychogenetic factors of their illness gradually came to direct their attention inward, and psychological treatment became possible (Morita 1977).

Another key Japanese center of influence for biofeedback and behavioral medicine in the Kyushu University Medical School's Department of Psychosomatic Medicine in Fukuoka City. Here, much work in the area of EMG and temperature biofeedback in the treatment of migraine, tension, and psychogenic headaches is being done. Recently, Ohno, Tanaka, and Takeya reported on a study they did to examine the changes in skin temperature induced by the muscular relaxation of EMG biofeedback in an effort to find a clue which might help clarify the therapeutic mechanism of biofeedback. Subjects were 20 female college students, ranging in age from 19 to 25 years (average 20.5 years). Apparatus used was a Model B-1 Bio-Electric Information Feedback System unit and a Bailey amplifying thermometer. Electrodes were placed on the forehead for skin temperature and EMG, and on the right index finger for skin temperature. Subjects were randomly divided into two groups of ten each: the biofeedback group and the control group without biofeedback. Each of the two groups were instructed to relax their forehead muscles and skin temperature was recorded during these efforts. Subjects received five training sessions of about 30 minutes duration, each on different days.

The results were as follows:

- In the biofeedback group, mean EMG levels of all subjects during all sessions decreased progressively and markedly during the five trials.
- The control group showed considerable and varied changes in skin temperature during the five trials and did not show constant decreases in EMB levels.
- The changes in EMG correlated with those in skin temperature of the forehead and finger in the biofeedback group, whereas the changes in EMG did not correlate with those in skin temperature in the control group.

Therefore, these data seem to suggest that vasodilation and the rise of temperature are passively induced by muscle relaxation, and EMG biofeedback can possibly be effective in the treatment of migraine (Ohno 1978).

In a study of seven patients with writer's cramp at Kyushu University, Akagi and Yoshimura recruited a control group of ten healthy subjects (5 male and 5 female), ranging in age from 21 to 30 years of age (mean age 25.5 years). In the first session, all subjects showed a significant decrease in EMG activity of the forearm using EMG biofeedback. However, the seven patients showed a higher EMG activity than the control group and found it more difficult to decrease tension. After ten sessions of EMG biofeedback training, conducted twice a week, some of the patients showed both subjective and objective improvements in their symptoms. In these cases, autogenic relaxation training was given in addition to the biofeedback. From this study, it was concluded that biofeedback training for the relief of writer's cramp is more effective when used in conjunction with a relaxation training such as AT (Akagi 1975).

Sonoda, Yamanaka, Nozoe, Takayama, and Kanehisa of Kagoshima University have also reported the successful treatment of a patient with writer's cramp through the use of EMG biofeedback. This patient was a 32-year-old male office clerk with a six-month history of writer's cramp. He gripped his pen tightly, bent his wrist inward and his handwriting deteriorated into a scrawl. As the first step in his treatment, he was taught autogenic relaxation and instructed to practice it three to four times a day at home. In the second phase of treatment, EMG electrodes were affixed to his forearm and he was asked to draw circles or horizontal and vertical lines with a pencil slowly and evenly while experiencing EMG biofeedback. Emphasis was placed on maintaining sustained relaxation in his right hand while writing. When he was able to draw these lines and circles smoothly, he was then asked to write simple capital letters and short sentences. In time, a soft pen was substituted for the pencil and eventually he wrote with a ball point pen. After twenty-two sessions of an hour or two duration each, over a period of five months, he was markedly improved and was able to return to work. A four-month follow-up showed the improvement had been maintained (Sonoda 1977).

Another successful report of autogenic training used with temperature biofeedback in the treatment of Raynaud's disease is from Kagoshima University. Takayama, Yamanaka, and Nozue worked with this patient, a 22-year-old female with a diagnosis of idiopathic Raynaud's disease. Pallor and cold hands had been present since the age of 12. In the past two years, she had suffered from severe cyanosis and pain of the extremities to the point of being unable to walk due to

the pain accompanying her Raynaud's episodes. Admitted to the Kagoshima University Hospital, she was taught the warmth phase of autogenic training as a first step in her treatment. Then, she underwent intensive hand temperature biofeedback training daily for three weeks. Over a period of six weeks, she undertook intensive foot temperature biofeedback training daily. By thermal biofeedback training, she was eventually able to raise her hand temperature to 35°C and foot temperature to 33°C. The initial training session showed hand and foot temperatures of around 22°C. Upon returning home, the patient continued daily autogenic training and a one-year follow-up evaluation determined that she essentially Raynaud's symptoms-free, with only occasional cold hands and feet (Takayama 1978).

Another interesting report of human experimental biofeedback, which has implications for clinical use in the treatment of insomnia, comes from Tokyo University's Faculty of Medicine and Department of Engineering and Physics. Operating on the theory that an increase in skin potential level (SPL) reflects not only the stage of sleep, but also human mental states of relaxation in general, Mabuchi, Kikuchi, Nishimura, and Nagumo constructed an SPL biofeedback system for the purpose of relaxing the mental tension of a subject to the point of unconsciousness. In this system, SPL information is fed back to the subject as a soothing auditory tone which varies in amplitude and frequency according to the level of SPL. The feedback sound lowers and quiets as mental tension decreases. Three different subject types were found among a large group of subjects. Those who were found to have the ability to spontaneously relax mental tension upon lying down and closing the eyes had no need for the system. Another type of subject reacted negatively and found that mental tension increased when this type of biofeedback was applied. The third type of subject, however, consisted of those who expressed difficulty in sleep onset, and it was this group of subjects who found the SPL system to be extremely pleasant and effective in inducing the sleep state. More research is being done in an effort to improve the quality of the sound being fed back, which, hopefully, will enhance future results (Mabuchi 1978).

PSYCHOLOGICAL/EDUCATIONAL RESEARCH

Interest in Japan seems to be growing in the use of biofeedback-monitored autogenic and guided-imagery-type relaxation training as both a treatment for, and, as a simple prophylactic method against various psychosomatic and psychoneurotic disorders in students. Often-heard psychosomatic complaints of students are insomnia, tension headaches, nervous stomach, coldness in the extremities, and excessive perspiration. Common psychoneurotic complaints are inability to concentrate, poor memory, vague feelings of anxiety, feelings of inferiority, lack of motivation to study, and examination anxiety.

One of the authors, Robinson, has counseled several thousand Japanese students over the past 14 years with the goal of reducing anxiety and perceived school stress, and improving the self-image in order to help the student perform to his or her academic potential (Robinson 1976, 1978).

In a recent study of 120 Waseda Yobiko Prep School students, deemed by the school to need extra help in the areas of motivation to study, concentration and memory, were enrolled in a GSR biofeedback training class of 11 weeks' duration. The 96 students who availed themselves of the training showed an average improvement in both self-concept and hensachi scores, $50+[10(X-\bar{X})/SD]$. The 24 students who skipped the class averaged a slight hensachi score decrease.

Relaxation Training Methodology

The 96 students received 50 minutes of GSR biofeedback-monitored relaxation training once a week for an 11 week period. Students were divided into eight groups of 12 each. At the beginning of each class period, students were seated in comfortable semi-reclining chairs in the school's biofeedback training center and were asked to attach sensors of their individual GSR BioMonitors to the fingerprint areas of the index and ring finger of the left hand. They were then given five minutes to practice relaxation and to establish their normal, resting baseline relaxation level. At the end of the five-minute period, they were asked to reset the controls of their BioMonitors to "0" and relaxation training of an autogenic and guided-imagery nature was conducted. As relaxation deepened, the audio signals of the GSR instruments quieted, and phase II of the training was initiated. In this phase of training, suggestion was used to motivate the students to develop more efficient study habits, to listen more intently in class, to realize the importance of their studies in relation to future success and happiness, and to be able to take their examinations in a relaxed and confident manner. The last phase of training included visualization exercises aimed at systematic desensitization of the examination-anxiety-syndrome. In this last phase, students were also instructed to visualize themselves as having already achieved their goals; and to visualize themselves studying more effectively, enjoying the learning process and receiving praise and admiration from their friends, teachers, and family.

Data Collecting Procedures

Subjective data was collected from each student after each relaxation training class, on a 3 x 5 "Critique of Training Session" card. The perceived degree of success or failure in relaxation, visualization, and GSR control, and perceived improvements in school or home life, attitude, study habits, and physical or mental health were written on the cards by the students. Objective academic progress data, in the form of exam grades and hensachi scores in relation to the other 10,000 Waseda Yobiko Prep School students, were obtained weekly from the computer.

Results

Data from this study indicated a positive and significant correlation between the frequency of biofeedback class attendance and improvement in self-concept, school grades, and hensachi scores. Students who attended BFT classes regularly (10 to 11 times) averaged a hensachi score gain of +6.158 (Table I). Those who attended BFT classes 8 to 9 times averaged a hensachi score gain of +5.075 (Table II). Students who attended BFT classes 5 to 7 times averaged a hensachi score gain of +2.554 (Table III). Students who attended BFT classes 1 to 4 times averaged a hensachi score increase of +1.458 (Table IV). The group of students who were enrolled for the BFT class but did not avail themselves of the training averaged a hensachi score loss of -0.279 (Table V).

Table I

Waseda Yobiko Comentar Class
May, June & July, 1978
BFT Class Attendance of 10-11 Times Group

Student's Computer I.D.	Hensachi Gain or Loss
61009	- 1.5
61012	+ 8.5
61017	+ 9.5
61060	+15.8
61061	+ 4.9
61062	+ 5.7
61082	+ 4.3
61084	+ 2.5
61122	+ 9.8
61125	+ 9.2
61126	+ 7.9
61128	+ 3.7
61136	+ 2.7
61144	+ 4.9
61145	+ 8.1
61151	+ 9.0
61158	+ 4.5
61166	+ 2.9
61171	+ 7.4
61172	+ 3.9
61175	+ 4.0
61182	+ 7.1
61187	+ 6.2
61198	+ 6.8
Group's Average Hensachi Gain:	+6.158

Table II

Waseda Yobiko Comentar Class
May, June & July, 1978
BFT Class Attendance of 8-9 Times Group

Student's Computer I.D.	Hensachi Gain or Loss
61016	+10.5
61026	+10.0
61036	+11.6
61039	+ 3.4
61042	+ 8.5
61050	+ 3.9
61057	+ 3.7
61058	- 0.8
61063	+ 6.4
61066	- 0.2
61075	+ 5.5
61076	+ 3.3
61079	+ 3.8
61087	+ 2.0
61088	+ 6.9
61090	+ 3.5
61106	+ 7.1
61108	+ 3.9
61116	+ 8.3
61135	+ 5.0
61146	+ 5.1
61165	+ 3.9
61168	+ 2.4
61174	+ 4.0
Group's Average Hensachi Gain:	+5.075

Table III

Waseda Yobiko Comentar Class
May, June & July, 1978
BFT Class Attendence of 5-7 Times Group

Student's Computer I.D.	Hensachi Gain or Loss
61018	+ 4.4
61021	+ 0.7
61031	+ 4.0
61038	+ 2.8
61043	- 2.7
61044	+ 2.8
61068	+ 3.0
61070	+ 3.1
61085	+ 3.0
61086	+ 2.6
61100	+ 2.3
61102	+ 3.1
61112	+ 0.1
61117	- 0.1
61119	+ 1.7
61129	+ 3.6
61140	+ 8.4
61169	+ 3.9
61178	+ 2.9
61179	- 1.3
61184	- 0.4
61195	+ 0.5
61200	+ 2.5
61202	+10.4
Group's Average Hensachi Gain:	+2.554

Table IV

Waseda Yobiko Comentar Class
May, June & July, 1978
BFT Class Attendence of 1-4 Times Group

Student's Computer I.D.	Hensachi Gain or Loss
61005	+ 7.5
61007	- 0.9
61011	+ 3.7
61020	+ 6.2
61023	- 3.6
61033	- 3.5
61041	+ 1.6
61048	- 1.1
61065	- 4.7
61067	+ 8.7
61071	+ 1.8
61073	- 3.4
61091	+ 2.0
61095	- 9.1
61099	+ 1.4
61109	+ 2.7
61111	+10.1
61132	- 1.8
61149	+ 6.2
61159	- 1.1
61167	- 1.5
61183	+ 5.1
61189	+ 6.7
61192	+ 2.0
Group's Average Hensachi Gain:	+1.458

Table V

Waseda Yobiko Comentar Class
May, June & July, 1978
BFT Class Attendence of -0- Times Group

Student's Computer I.D.	Hensachi Gain or Loss
61028	- 1.2
61040	+ 7.0
61040	- 1.2
61049	- 1.0
61051	+ 6.0
61053	+ 1.4
61059	- 1.6
61077	- 3.3
61081	+ 5.7
61093	- 8.4
61094	- 6.0
61097	+ 9.4
61118	+ 6.1
61127	- 4.4
61138	- 7.3
61139	- 7.6
61152	+ 1.7
61180	+ 7.2
61181	- 4.4
61185	- 4.2
61188	- 1.9
61194	- 1.2
61196	+ 2.5
61201	+ 1.4
Group's Average Hensachi Loss:	- 0.279

It is believed that the ability to relax at will and to exert a high degree of self-control was a key factor which enabled 82 of the 96 BFT students to pass their examinations for entrance to the university of their choice. This biofeedback-monitored autogenic, guided-imagery relaxation training class for the enhancement of motivation, study skills, and self-concept is now offered one semester each year at the Waseda Yobiko Prep School, and is becoming increasingly popular (Robinson 1979).

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APPENDIX I

Mailing Addresses of Principal Investigators Mentioned in this Article

The Oskar Vogt Institute
Medical School Hospital
Kyushu University
1-1, Maide 3-chome, Higashi-ku
Fukuoka, Fukuoka 812, Japan
Dr. Wolgang Luthe, Scientific Director

Department of Psychology
Kwansei Gakuin University
1-155, Kamigahara 1-bancho
Nishinomiya, Hyogo 662, Japan
Dr. Yo Miyata
Dr. Yoshio Inamori

Department of Psychology
Doshisha University
Imadegawa-dori Karasumaru Higashi-iru
Kamikyo-ku, Kyoto 602, Japan
Dr. Haruyo Hama
Dr. Yasuko Kawamura
Dr. Yoshinori Matsuyama
Dr. Hiroshi Mine

Department of Physiology
Kyoto Prefectural University of Medicine
176-1, Taichoro, Fushimi-ku
Tokyo 612, Japan
Dr. Keizo Suzuki

Department of Psychology
Sophia University
7, Kioi-cho, Chiyoda-ku, Tokyo 102, Japan
Dr. Hisashi Hirai
Dr. Fumio Yagi

Medical School Branch Hospital
University of Tokyo
28-6, Mejirodai 3-chome, Bunkyo-ku
Tokyo 112, Japan
Dr. Hiroshi Ishikawa
Dr. Mitsuo Kezuka
Dr. Yuriko Morita
Dr. T. Morishita

Department of Psychosomatic Medicine
Medical School Hospital
Kyushu University
1-1, Maide 3-chome, Higashi-ku
Fukuoka 812, Japan
Dr. Yoshiteru Ohno
Dr. Y. Tanaka
Dr. T. Takeya
Dr. Minoru Akagi

Medical School Hospital
Kagoshima University
1208-1, Ushuku-cho, Kagoshima
Kagoshima 890, Japan
Dr. Jun-ichi Sonoda
Dr. T. Yamanaka
Dr. S. Nozue
Dr. Iwao Takayama
Dr. Kanehisa

Faculty of Engineering
Tokyo University
3-1, Hongo 7-chome, Bunkyo-ku
Tokyo 113
Dr. Kunihiko Mabuchi
Dr. Takenori Kikuchi
Dr. C. Nishimura
Dr. Jinichi Nagumo

R & D NEWS ITEMS ON ELECTRONIC MATERIALS IN JAPAN

Young B. Kim

SUPERCONDUCTING JOSEPHSON JUNCTION

On July 1, 1980, the Institute of Physics and Chemistry in Tokyo announced to the news media the development of a new type of superconducting Josephson junction. It is claimed to be easily mass-producible, long-lived, and to pave the way for superconducting Josephson computers that will work 50 times faster and yet consume only one one-thousandth of the power used in the modern semiconductor-based computers. Dr. Hiroshi Ohta, who developed this new Josephson junction element, calls it "quasi-planar" because it combines the advantages of the planar-type micro-bridge junctions (durable but difficult to mass-produce) and the layer-type thin film junctions (efficient but short-lived).

The following details were learned from a visit to Dr. Ohta's laboratory. The new Josephson junction developed by Ohta consists of two Nb electrode films sputtered on quartz substrates which overlap slightly at one edge. At this stage of processing, the two Nb films, 2,000 Å thick, are separated by a 750-Å-thick SiO_2 spacer. The structure is free from pinhole-type shorts that often plague thin metal-oxide tunnel barriers used in the layer-type thin film junctions. The overlapping area is sputter-cleaned prior to Bi sputtering so that the Bi film to be deposited will make intimate contacts with the surfaces of top and bottom Nb films as well as the edge surfaces of the top Nb film and SiO_2 spacer. The Bi film so formed is apparently semimetallic (the electrical resistivities are 2.7 and 2.2 mΩ-cm at 4.2 and 300 K, respectively) and plays the role of metal-oxide tunnel barrier in the conventional layer-type thin film junctions. The Josephson characteristics of the Bi film are, however, much more stable and less sensitive to the film dimensions. In this structure, both electrodes are Nb, which is stable and resistant to damage by repeated thermal recycling; yet the difficult process of forming niobium oxide layers is avoided since the sputtered Bi film (750 Å active length) acts as the tunnel barrier. For the junction made by Ohta, the capacitance is calculated to be 0.04 pF (overlapping area 5 by 15 μ, 750-Å-thick SiO_2 spacer film of specific dielectric constant of 4.5). Obviously, the capacitance of the junction can be readily controlled depending on the specific need.

All the processes of junction fabrication of this new "quasi-planar" Josephson junction are carried out by *in situ* sputtering, which can readily be adapted to mass-production processing. While Ohta's work on this new Josephson junction is continuing to elucidate in detail the dependence of Josephson characteristics on different variables, and to try a variety of different materials for the barrier, Japanese companies working on Josephson computers are showing keen interest in adopting this new junction configuration for practical applications.

The Japanese R&D community is well aware of the current effort by I.B.M. in the U.S. to develop Josephson computers by means of lead-based thin-film alloy junctions. The Josephson junction work at the Institute is supported by the Science and Technology Agency, and they have jointly applied for a patent for this new device in the United States. Independently, a MITI-supported effort to develop Josephson computers is currently underway at four Japanese companies: Fujitsu, Hitachi, Mitsubishi, and Nippon Electric.

R. F. Broom et al. of the IBM Zurich Research Laboratory have recently published in the Applied Physics Lett. *37*, 237, 15 July 1980, their work on Josephson junction structures which are conceptually similar to that of Ohta.

HIGH ELECTRON MOBILITY TRANSISTOR

Fujitsu Laboratory announced its successful fabrication of ultrahigh-speed transistor called HEMT (high electron mobility transistor) from Ga-As by means of computer-controlled MBE (molecular beam epitaxy) crystal growing. In this fabrication process, two thin layers of Ga-As are MBE-grown on Ga-As substrate, one layer pure and the other layer containing a small amount of silicon. In such structure, it had been known that electrons emitted from silicon

donors are confined to move in the boundary layer and attain very high mobility. Fujitsu succeeded in arranging gold-alloy electrodes in this boundary layer to make HEMT.

HEMT is said to be ten times faster than Ga-As-based transistors developed earlier by Musashino Electrocommunication Laboratory of Japan Telephone & Telegraph Corporation; it is 50 times faster than the conventional silicon-based transistors. Fujitsu is taking steps for practical device applications of HEMT, including logic elements in high-speed computers, microwave amplifiers, optical integration circuits. (This new fabrication technique was to be reported at the Electron Devices Research Conference held at Cornell University at the end of June.)

INTEGRATED CIRCUIT FROM GALLIUM ARSENIDE

Electrocommunication Laboratory of Japan Telephone & Telegraph Corporation announced its successful attempt to fabricate a logic circuit using normally-off type Ga-As Schottky junction transistor MES FET (metal-semiconductor field effect transistor). At room temperature, the gate propagation delay time is measured to be only 30 ps with 1.9 mW power consumption. At liquid nitrogen temperatures, it can be reduced to 17.5 ps with 9.2 mW power consumption. To achieve this result, the length of the gate electrode was shortened to 0.5 μ by means of direct electron beam lithography. The thickness of the other parts was increased to reduce parasitic resistance and the capacitance was reduced by arranging lead wire parts to cross each other. The active layer of FET was made thin and uniform by refined etching. The logic circuit fabricated was contained in a 2-mm square. Larger-scale integration is being attempted with improvement in crystal uniformity, planarization of active elements, adoption of dry processing, and application of thin layer of protective coating.

BETTER QUALITY SILICON WAFERS

Sony Company announced publicly their newly-developed technique of processing pure silicon single crystal. This technique is called the MCZ (magnetic-field Czochralski) method in which 2,000 G magnetic fields are being applied during the crystal pulling process. The magnetic field applied to the silicon melt, which is electrically conductive and is subject to Lenz's law, effectively suppresses the thermal convection currents in the melt. Consequently, the surface of the silicon melt becomes smooth and almost stationary, and the temperature fluctuation is reduced to a very stable, constant level. This, in turn, ensures smooth and uniform growth of the silicon crystal with negligible growth striations, which are caused by local impurities. This new method also can reduce the ocntent of oxygen dissolved in the silicon crystal to one tenth of that in the CZ method, as the suppression of thermal convection currents greatly lessens the chance of silicon melt to chemically interact with the silica (SiO_2) crucible.

From the standpoint of silicon wafer and device processing, the crystal grown by the MCZ method is claimed to have the following advantages:

- Crystal defects can be reduced dramatically,
- Wafer distortion and warpage decrease drastically, and
- Resistivity fluctuation can be minimized.

This new method was reported at the St. Louis Electrochemical Society meeting held in May, 1980, and Sony's technical description of the MCZ method is available at the ONR Tokyo office.

NEW DEVELOPMENT IN OPTOMAGNETIC DISCS

KDD (International Telegraph & Telephone Corporation) has developed a new type of optomagnetic disc from thin films of ternary alloy (Gd-Tb-Fe), which can be packed with information density, 5 million bits per sq cm, about ten times the packing density presently achievable with magnetic discs. In other attempts to develop optomagnetic discs using binary alloys (Mc-Bi or Gd-Co), tens and hundreds milliwatts of light power are required for information recording. In contrast, the new disc requires only several milliwatts for recording and, furthermore, information readout can be achieved with a larger light power output and less noise. Laser light from Al-Ga-As diode is used for information writing and readout as the direction of light polarization changes, depending on the local magnetic states of thin films.

ANZAAS JUBILEE CONGRESS

Leon H. Fisher

INTRODUCTION

The ANZAAS (Australian and New Zealand Association for the Advancement of Science) Jubilee Congress was held on the campus of the University of Adelaide, South Australia, May 12-16, 1980. Attending the Congress was not the primary purpose of my visit to Australia, and so I was only able to be present at the conference for two days of the five-day meeting. This report gives some general facts about ANZAAS and the Jubilee Congress. It also reports, in detail, sessions which I attended.

NATURE OF ANZAAS AND ANZAAS CONGRESSES

ANZAAS was founded in 1888 and the first ANZAAS congress was held in Sydney in the same year. Since then, congresses have been held, in rotation, in the major cities of Australia and New Zealand about every 18 months. Under this arrangement, the congress is held in New Zealand about every ten years. The congress, preceding the present one, was held in Auckland, New Zealand. Starting with the present congress, and continuing at least for the next four years, congresses will be held every twelve months. The 51st ANZAAS Congress will be held in Brisbane, Queensland, May 11-15, 1981, and the congress theme will be Energy and Equity. Succeeding ANZAAS congresses will be held in Sydney, Perth, and Canberra. The meetings are held on university campuses, and the one in Sydney, in 1982, will be held on the campus of Macquarie University. A special celebration will occur in 1988. In that year, the congress will be held in Sydney 100 years after the founding of ANZAAS, in the same city in which the first ANZAAS Congress was held.

The purposes of ANZAAS are quite similar to those of the AAAS. In 1893 it was stated that "the objects of the Association (ANZAAS) are to give a stronger impulse and a more systematic direction to scientific inquiry; to promote the intercourse of those who cultivate Science in different parts of the Australian Colonies and in other countries; to obtain more general attention to the objects of Science, and the removal of any disadvantages of a public kind which may impede its progress."

ANZAAS has pursued its objectives in other ways as well, such as acting as host in the beginning of many specialist societies which now run their own national conferences. ANZAAS also makes money grants, and helps found journals. The society also publishes a journal *Search* which appears ten times a year. It is not on as high a level as *Science*.

ANZAAS has a membership of about 2,500. About 500 members attend the congresses, but the total attendance at a congress is much larger and varies between 2,500 and 5,000. This attendance is quite respectable, considering the population of the two countries. Despite strong attempts to get the general public interested in ANZAAS congresses, very few nonprofessional people attend.

The subjects of concern to ANZAAS are handled by sections relating to such subjects. At present, there are 34 regular and six trial sections in ANZAAS. ANZAAS is concerned with a number of fields normally not considered as "science." For example, history was one of the earliest sections formed. The names of some sections with somewhat surprising titles for such an organization are architecture and planning, education, linguistics, history, sociology, sports science, musicology (trial section), and health education (trial section). Each section has a president, and each section president gives a presidential address at the congress.

THE JUBILEE ANZAAS CONGRESS

The theme of the Jubilee ANZAAS Congress was "Science for a Sustainable Society for US (US stands for Australia not U.S.A.) by 2000 A.D. Why? How?"

The congress included a large number of "Congress Symposia" of a rather reflective nature. In addition, section programs consisting of their own symposia and contributed papers were organized. Contributed papers were presented in poster sessions.

The titles of the "Congress Symposia" were:

- Freedom in the Age of the Computer,
- Energy for a Sustainable Society: The Outlook to 2000 A.D.–South Australia as a Case Study,
- Passports for Pathogens: The Immigration of Infectious Diseases,
- What Risks Can We Afford? The Assessment of Risk in Relation to Benefit,
- Science and the Media,
- Use of Our Arid Zones,
- Computers and Jobs,
- Energy for a Sustainable Society: The Longer Term Outlook,
- High Cost Medical Technology–Threat or Promise?,
- Medical Genetics and the Law,
- Brain and the Modification of Behavior,
- Land Resources for Agriculture and Forestry: Problems of Urban Sprawl,
- Human Sexuality in a Sustainable Society,
- Energy, People and the Environment,
- Evaluation Research in the Public Sector,
- Human Influence on the Global Atmosphere and Climate,
- Improving Co-operation and Communication between Scientists and Industry,
- Management of Water Resources,
- The Meaning and Consequences of a Stationary-State Economy in Australia,
- Genetic Engineering: Recombinant DNA Technology, Its Current Applications and Future Prospects,
- Lead: A Technological Addiction?,
- Telecommunications in the Society of the Future,
- Australia's Ocean and Us.

It may be of interest to note that the following Americans participated in the above symposia:

- E. E. David, Jr., Exxon Research & Engineering,
- Gene Elle Calvin, Berkeley, California,
- Alexander R. Margulis, School of Medicine, University of California, San Francisco,
- Margery W. Shaw, Medical Genetics Center, University of Texas, Houston,
- Marion Clawson, Resources for the Future, Washington, D.C.,
- Mary S. Calderone, Sex Information and Education Council of the U.S., and
- James W. Ramey, Center for Policy Research, New York.

The program of the physics section will now be discussed. The physics program consisted of the section's presidential address by R. W. Crompton, Ion Diffusion Unit, Australian National University, Canberra, entitled "Electrons and Ions in the Atmosphere," and oral reviews by a number of authors in each of five general areas, and contributed papers "presented" in poster sessions. The five general areas covered were:

- Physics Education in Schools, Tertiary Institutions and Continuing Education Groups,
- Quantum Physics of Molecules, Atoms and Nuclei,
- Physics of Space and Time,
- Alternative Energy Technologies, and
- The Earth, the Sea and the Sky.

The only non-Australian/New Zealand author to present a paper in the five sets of reviews was R. Karplus of the University of California, Berkeley.

The remainder of this report will be devoted to a detailed discussion of Crompton's presidential address and to those papers arranged by the physics section which I heard.

Crompton's address discussed four topics: the role played by electrons, and by negative and positive ions, in the aurora; the preservation of the ozone layer; ball lightning; and the effect of ions on human behavior and performance. The discussion of auroras and the ozone layer are quite usual topics for scientific meetings; ball lightning and the effect of ions on human behavior are considered to be controversial subjects. A discussion of Crompton's treatment of three of these four topics follows.

The structure of the atmosphere out to hundreds of earth radii was described briefly and the importance of the space program's contributions to the understanding of the aurora was noted. Less than 20 years ago, the aurora was usually explained in terms of the electrons and protons of the solar wind spiralling down towards the magnetic poles of the earth along magnetic field lines, the primary source of the energy being simply the kinetic energy with which they left the sun's surface. This explanation fails to account for the energy associated with the auroral discharge or why the aurora is confined to an irregular belt about one of the magnetic poles. Crompton discussed the correct explanation based on an understanding of the plasma physics associated with the sun-earth system and its associated magnetic fields and ionized particles.

In contrast to the understanding of the aurora which has been so dependent on the space program, the role of ion-molecule reactions in the preservation of the ozone layer has, so far, depended almost exclusively on the result of laboratory experiments. Crompton discussed the effect of these reactions on the stratosphere, the region of the atmosphere at around 30 km, which contains the bulk of the atmospheric ozone. Crompton reviewed the deleterious effects on living matter of ultraviolet radiation which is essentially filtered out by the ozone layer. The bulk of the treatment was devoted to the possibility of the partial destruction of the ozone layer by the catalytic action of free chlorine produced by the photolysis of man-made chlorofluoromethane gases. One atom of chlorine produced by the photolysis of a chlorofluoromethane molecule could destroy hundreds or thousands of ozone molecules before it itself is removed from the ozone layer. A complex discussion of the reaction rate measurements necessary to solve this problem was given. From the known and calculated data on the relative abundances of the many neutral and charged species known to be present in the troposphere and stratosphere, it has been possible to demonstrate that the ozone layer is not self-healing against damage from the chlorofluoromethanes. The chlorofluoromethane concentration will not build up to its maximum for decades.

Not too many years ago, ball lightning was considered by authorities to be a figment of the imagination. In "The Flight of Thunderbolts," a fascinating book written in 1950 by B. F. J. Schonland, a world-respected leader in lightning research (now deceased), stated that there was not a single well-documented case of ball lightning. But, in 1955, the world-famous Soviet physicist and subsequent Nobel Prize winner, P. Kapitza, came up with a theory of ball lightning, although Kapitza pointed out (and I believe it is still true) that there are no indications that the phenomenon of ball lightning has been successfully reproduced under laboratory conditions. Kapitza's theory proposed that ball lightning is a high-frequency rf discharge and depends on the existence of such fields in lightning discharges; such fields, however, have not been observed in lightning discharges. Nevertheless, Kapitza's paper started ball lightning on its way to respectability, and more and more eminent physicists have come to believe in its existence. (As a matter of fact, doubters may be socially ostracized). Crompton discussed some other proposed theories for ball lightning.

Crompton recalled the Oak Ridge National Laboratory study in 1960 in which 500 out of 16,000 claimed to have seen ball lightning. He pointed out that there are as yet very few photographic records of ball lightning itself (most reports are from visual memory, and many long after the fact) and appealed to his audience to keep their cameras handy in thunderstorms. Crompton has become very interested in the phenomenon and asked people to contact him if they see ball lightning.

ALTERNATIVE ENERGY TECHNOLOGIES

In "Liquid Fuels from Coal," I. McC. Stewart of the University of Newcastle, N.S.W., pointed out that the present consumption of oil in Australia is 30% above the indigenous supply, although Australia is not now burning oil for power generation.[1] Nevertheless, Australia will want to double its oil imports before the end of the century. However, the rest of the world will not agree to this. Therefore, the supplying of an adequate amount of liquid fuel for Australia is a matter of national independence. If Australia does not solve its liquid fuel problems, it will become completely subservient to other nations. The failure to provide adequate liquid transport fuel would be suicidal. Australians should consider four goals:

- more economic use of fuel,
- obtaining alcohol from biomass,
- obtaining oil from shale (there is no certainty that the low grade shale in Australia will be suitable for this), and producing oil from coal.

Stewart considers this last possibility the most hopeful for Australia. Australia has plenty of coal. However, coal is a most complex and variable substance, perhaps the most complex and variable substance used by man. The molecular structure of coal is very complicated and there are many kinds of coal. There are variations even from band to band in the same coal seam. Thus, there are and will be complex problems in handling coal in the commercial conversion to liquid fuel. Nevertheless, the immediate problem in Australia is to produce oil from coal and to consider the problems of commercial development of such a process. One must not underestimate the large and real problems in carrying this out. Not enough is known about coal minerals and the combustion process of this extremely variable material.

The conversion of coal to liquid fuels requires the hydrogenation of the coal since the ratio of hydrogen to carbon in petroleum fuels is larger than it is in coal. The only coal liquefaction plant operating commercially is in the Republic of South Africa. It involves the gasification of coal, gas cleaning, and then a catalytic converter. This plant has been operating for about 25 years. If coal is to be gasified, Stewart stated that the earth should be used as a gas container. We are getting pretty close to the point where we can gasify coal underground. Underground gasification has many advantages, but it is still under development. It eliminates the need for underground miners and has environmental advantages.

The favored route, at the moment, to produce liquefied coal is to dissolve the coal in a solvent and to hydrogenate, using pressurized hydrogen. This requires low-ash, reactive coal, and would make good gasoline. The residual would make poor diesel and aviation fuel. Alternatively, pyrolysis should be considered. During pyrolysis, coal is heated to a high temperature in the absence of air. During this process, the coal is distilled and a redistribution of the hydrogen in the coal produces liquid and gaseous products, leaving coke behind. Liquids obtained from pyrolysis of coal are tars that require hydrogenation to make them useable as liquid fuels. Minerals should be removed from these tars before hydrogenation, and this is, as yet, an unsolved problem. Nevertheless, these tars could be removed in principle before the remaining material is used in power stations. Pyrolysis is at present a major activity of CSIRO at Ryde.

Returning to hydrogenation of coal directly, one should note that there are two methods, catalytic and noncatalytic. There are now no coal hydrogenation plants in operation, although there were several in the United States and in Germany before and during World War II. These plants were closed because of the low price of petroleum. However, it is well to remember that in World War II hydroliquefaction plants processed coal right through to gasoline as the major product. In the United States at the present time, coal is being used to yield heavy oil for power generation, but these U.S. activities are only partially relevant to what Australia needs to do.

It is essential to determine the behavior of Australian coals in regard to hydroliquefaction and the removal of residues and to understand catalytic effects. Oil refining is at present still an empirical art. The design information to process coal liquids to gasoline and diesel fuels must be obtained.

For about $20 million, one could build a coal test facility to assess the commercial performance of Australian coals for the production of light transportation fuels. For $400 million, a semi-commercial demonstration plant could be produced to handle about 10,000 tons of coal a day. The figure of abou 100,000 barrels per day is generally quoted as the output of a $10 billion plant. This will be about 10% of the total Australian demand in 2000 A.D.

Stewart pleaded for much stronger incentives for entering into a liquid fuel economy, and for a national 20-year program. It is almost too late now. Solar power is a luxury Australia cannot afford according to Stewart.

In "Techniques for Ultimate Disposal of Radioactive Waste Materials," E. W. Titterton (Sir Ernest) of the Australian National University, Canberra, gave his view that the only viable source of energy for the future is nuclear energy. The last time I had seen Titterton was when he was a young man in charge of electronic circuitry at Low Alamos in 1945 or 1946. Titterton is now one of the most colorful (and controversial) figures in Australian science.

He pointed out that the difficulty of disposing wastes is not unique to the nuclear industry. A 2000-MW coal-fired plant produces 90 tons of arsenic, 20 tons of poison gas, and 600-700 hundred tons of heavy metals daily. There are 13 million people in Australia producing 4.5 million tons of household refuse and 6 million tons of industrial refuse annually.

Environmentally, the nuclear industry has enormous advantages over coal. Fission products are short-lived but actinides are long-lived. Actinides are α-emitters; they are harmless unless ingested. The fast breeder reactor is the power plant of the future. "It is utter and complete rubbish that nuclear power will give rise to radioactive materials for millions of years." The actinides may give problems for about 100,000 years. The liquid fuels can be placed into a matrix of glass and placed in welded stainless steel containers. Such a process is going forward commercially at present the world over. Consider 2,500 power stations by year 2000. This would give rise to 72,000 cylinders of vitrified waste for 1956-2000. They could be put onto the floor of the Atlantic Ocean immediately after vitrification. The stainless steel can be penetrated immediately. The monolithic glass cylinder breaks up into pieces of about 3 cm radius. All of the vitrified waste is dissolved within 3500 years. This would not produce as much radioactivity as there is at present, naturally or from weapons tests fallout. One would avoid sections of oceans which may be commercially useful.

Ice sheet disposal concepts were discussed. If a cylinder were to be placed in the top of an ice sheet, the cylinder would melt the ice and fall in the ice, providing an even further delay than if directly placed in the ocean.

Another proposal is to dispose of the material in deep rocks. At the Australian National University, studies on this problem are being carried out with artificial rock mixtures in which the material to be disposed of would fall in molten rock.

The deposit of waste by shuttle launch deployment is feasible, but not necessary, according to Titterton. He also stated that coal is too precious and too exhaustible a commodity to use up.

I. R. Jones of Flinders University of South Australia gave an extensive review of the present world-wide magnetic confinement thermonuclear program in his paper on "Fusion."

He outlined the basic problems of fusion power production, the heating of the fuel to about 10^8 °K, a temperature much hotter than exists in the center of the sun, the confinement of the plasma with walls cooling the plasma and impurities radiating electromagnetic energy because of their high atomic numbers. Of the two confinement schemes, magnetic and inertial, magnetic confinement at present is the dominant effort. Another problem is how to extract the energy out of the reaction, once it has been ignited. The possible use of a lithium blanket with Li^6 absorbing a neutron to give He^4, H^3, and 4.6 MeV of energy was mentioned. The heat could be removed by cooling. There is also the possibility of direct conversion by electromagnetic means.

The D-T reaction consumes deuterium and lithium (to make the tritium), and since the supply of lithium is finite, eventually the D-D reaction will have to be used.

The following environmental considerations for thermonuclear power obtain

- no possibility of a runaway reaction,
- no waste heat rejection, and
- does not produce plutonium or any other weapon material.

The most significant environmental hazard is the possible leakage of tritium. Tritium has a physical half-life of 12.3 years and a biological half-life of 12 days. It does not collect in bones, and it is a low-energy α-emitter.

The first Tokamak was developed at Novosibirsk. One had been constructed at the Australian National University, but was not followed up at the time. Australia "missed the boat." Since 1968, Tokamak research has exploded and has dominated fusion research for the last 12 years. An extensive description of various Tokamaks was given along with their costs and their plasma heating schemes. Both neutral beam heating and rf heating were discussed. No more detail than this is given because the report on the International Plasma Physics appeared in this Bulletin 5 (2), 1980. Jones' own work will be discussed elsewhere since I visited him at his laboratory at Flinders University of South Australia subsequent to the congress.

After the above papers, a lively (to put it mildly) panel discussion was held. The panelists included Titterton, Jones, and Stewart, as well as Robin Storer of Flinders University of South Australia, who is interested in wind energy, S. Koneff, a solar scientist, and G. Lawrence, who is interested in solar chemistry. The theme of the panel discussion was: "2050 - Will we have an oil technology?" It was further broken down into the following questions:

- Will we have an all-electrical society?
- Will there be central or distributed power generation facilities?
- Will fusion still be anticipated?
- Will nuclear opposition prevail?
- Will anarchy prevail?
- Will scientists believe in engineering reality?
- Will we have a hydrogen economy?
- Can capitalist economies cope with the calls for capital?

Lawrence felt that petrochemicals will overburden the biosphere, and that all the O_2 in the atmosphere will be burned. Storer called for slowing down growth so that anarch will not prevail. He spoke in favor of distributed power supplies. Although wind energy is not a complete answer, one can get 1 or 2 MW from the wind, now, at a capital cost of $1000/kW; and, in this way, small communities might be able to survive. Jones discussed the need for a benchmark prototype fusion reactor which, if it worked, would lead to a full-scale operational reactor. It would take 15 years to produce a prototype reactor if a crash program were to be undertaken. It would take 45 years for the construction of a full-scale reactor and would cost some $15 billion. A commercial network could be in place by 2050.

Titterton talked about the coming growth in world population, and commented that the rest of the world would demand as much power per capita as the developed countries. He said that the extensive use of coal ought not to be allowed, that it was "scandalous," that our standard of living, including the production of pharmaceuticals, is bound up with coal, and that, unless something is done, all fossil fuel will be gone in 200 years. There is no alternative to nuclear energy. Up to 2050, fission reactors would be used and, after 2050, fusion reactors will come into play.

Stewart stated Australia must get into action on the short-term issue of producing adequate supplementary liquid fuels. Nuclear power is not as cheap as hydrocarbons and has a much higher capital investment. His plea is that Australia has lots of low-sulphur coals which will help Australia survive the next 25 years; Australia cannot afford small windmills and solar heaters.

THE EARTH, THE SEA, AND THE SKY

In "Satellite Observations and the Physics of the Earth's Interior," K. Lambeck of the Australian National University discussed what satellite observations tell about the physics of the earth's interior. Subjects of interest are

- travel times, amplitudes, and frequencies of earthquakes,
- heat flow through the mantle of the earth,
- electrical and magnetic properties of the earth, and
- gravity.

Lambeck concentrated on his own area of geophysics, geodesy. The motion of a satellite about the earth is a function of the variation of the earth's gravity due to lateral variation of g, solar variations; tidal variations; and these all cause perturbations on the motion. The effects of direct solar and lunar attractions and the effect of winds are very complicated. The earth's precession and other factors must be taken into account. This leads to a highly nonlinear equation. The tracking accuracy is now of the order of 10 to 20 cm with the help of lasers. None of the parameters are known and they must all be obtained from the observations. The NASA uranium core satellite was mentioned as being very dense to reduce air drag and radiation pressure. For high altitudes such as 1000 km, the orbits are not especially sensitive to variations in g. If one lowers the satellite, one gets into drag problems. Lambeck discussed the technique of getting satellite observations at lower altitudes by putting a satellite within a satellite. The inner satellite is protected from all surface forces by jets activated to keep the inner satellite free. Data from such vehicles will be important. Such vehicles have not been flown at 200-300 km but at least one has flown at 800-900 km.

The measurement of the geometric surface of the sea may be a measure of the gravity of the earth. The possible applications of measuring continental drift and plate tectonics were discussed.

R. R. Brook of the Australian Meteorology Bureau discussed the general directions and trends of meteorology in Australia. The per capita expenditure on meteorology in Australia is comparable to that of the United States. About $40 million is spent annually and 1600 people are employed. Ten years ago, it was thought that meteorology could be

modelled numerically, and Australia has invested a large fraction of its resources in numerical meteorology. About one-half of the bureau's resources now go into numerical meteorology. However, the prediction of weather has not improved dramatically with this procedure. Up to the 1950s, human judgement was used to predict the weather. Now, with the use of computers, forecasters might have been expected to have become an extinct species, but this is not so.

There is a new project using the methods of decision analysis. This is a study of how forecasters make forecasts and which type of forecast is best made by computers and which is best made by forecasters. This is related to cognitive psychology. Brook does not believe that numerical meteorology should get the lion's share of Australian meteorological funds.

In the 1980s, one will continue to dot the i's and cross the t's in meteorology. The big advance will be in technology and not in basic science. There is no consensus about Australia's meteorological needs as related to agriculture, aviation, off-shore oil, and the needs of the general public. The CO_2 problem is increasingly worrisome; the temperature of the atmosphere will increase. The problems of ozone, air pollution, fresh water from Antarctica, and a world climate program will be problems of concern. In general, it may be stated that meteorologists in the 1980s will be moving far away from weather forecasting.

R. Henderson of Geoex Pty. Ltd., Adelaide, discussed the application of physics to the commercial exploration of minerals. The commercial exploration of minerals is especially important in Australia because of the vast coal deposits in Queensland, and because Australia has the largest uranium deposits in the world. The physical properties used are limited to the following:

- magnetic susceptibility,
- electric conductivity,
- elastic parameters,
- radioactivity,
- thermal conductivity, and
- density.

Of the above six properties, only electrical conductivity, elastic parameters, and radioactivity were discussed as there have been big advances in the measurements of these three properties.

Recent developments in electronics, which permit miniaturization of equipment and increased capacity for automatic operation and processing of data, are finding useful applications. New applications to coal, oil-shale, and uranium prospecting using new airborne, ground and downhole geophysical techniques were discussed.

A gamma-ray spectrometer is now being used in the air. On the ground, transient electromagnetics are being used to detect nature of deposits. A current in a coil is turned off and eddy currents are detected with receiver coils. At present, a small 24-V dc portable supply console is available for this work. Another technique being used is to study the effect of polarization (electrolytic) and to determine whether the polarization is caused by economic or by uneconomic minerals. There is work going on using this technique trying to discriminate between black shales and economic minerals. The search for uranium might be helped by this technique. If bore holes are used, the sensors are placed within the rocks and eliminate surface effects. Seismic techniques using such explosions were discussed, using reflections and refraction information. From this technique, one can determine the structure of rocks and location of gas and oil. A development in the last two years in high resolution seismic work has occurred, and has just been applied in the last two months. This involves getting information from two boreholes simultaneously.

In "Oceans and Coasts," R. Radok of Horace Lamb Institute, South Australia, gave a masterful review of the present knowledge of oceans and currents surrounding Australia and compared this with the observations of Matthew Flinders (1774-1814), explorer and navigator. Radok quoted extensively from Flinders' journals, and one came away from the lecture realizing that Flinders must have been a genius.

Flinders explored ocean currents around Australia, starting in the early part of the nineteenth century. One crossing from South Africa occurred in 1801. Flinders was puzzled by the sudden changes in the directions of ocean currents. On the south coast of Australia, the wind explained the ocean currents to Flinders, but not so on the east coast. In 1969, drift cards were released around Australia and were found in different countries, and this gave information about current

directions. However, only after signals from buoys were observed from satellites, could one go beyond the observations of Flinders. In general, Flinders' observations have held up very well. It is interesting to note that Flinders, from his observations, deduced that Australia was not broken up by an inland sea. However, some observations of Flinders on the Barrier Reef were incorrect. The current patterns near Townsville are much more complex than suggested by Flinders. The paper concluded with a general talk about the oceanographic problems of Australia.

B. H. Briggs of the University of Adelaide spoke on "The Middle Atmosphere." By the middle atmosphere is meant the region between 10 and 100 km from the stratosphere to the mesosphere. We know less about the middle atmosphere than about the rest of the atmosphere. The upper atmosphere has been investigated by radio physics. The ionosphere begins about 70 km and goes up to 400 km. There has been no means of investigating the middle atmosphere. Most information has come from rockets. These are expensive and give a single section through the atmosphere with no time resolution, no horizontal resolution, and no global coverage. The first orbiting satellites sampled the region through which they travelled and contributed nothing to the knowledge of the middle atmosphere. The situation has changed drastically recently and depends on remote sensing from the ground or from a satellite. Recent developments allow satellites to look at radiation from the middle atmosphere and to determine trace materials and temperature profiles. Another development is to use radar from the ground to observe fluctuations in the density.

Meteors ionize air from 70 to 100 km. With radar, one can get reflection from the ionized trail. If one measures the Doppler shift in the scattered radar signal, one can measure the velocity of the meteor trail and one can determine the velocity of the wind which is moving the meteor plasma. Actually, one needs three observations to get the wind velocity. One can compare the wind velocities obtained from balloons and radar and get good agreement from 0 to 24 km. Radar remote sensing from the ground is able to give wind measurements up to 100 km. Satellites only measure temperature and composition, and, thus, satellite and ground-based observations complement each other in every aspect.

One would like to know the following properties of the middle atmosphere:

- composition (including aerosols),
- temperature,
- dynamics, and
- electrical (ionic and electronic).

A review was given of what we now know about the middle atmosphere. The ozone layer is in the middle atmosphere, and the study of ozone is a vital part of the middle atmosphere. The temperature of the middle atmosphere depends on minor constituents. Ozone is the chief absorber of ultraviolet and is the chief determinant of winds in this region. Aerosols are another important minor constituent of the middle atmosphere. Laser echoes from such particles have been observed as well as their variation with time.

The present knowledge of the temperature from 0 to 70 km comes from rocket data, and from smoothed out averages from different times, and mostly from the Northern Hemisphere.

Because of the above considerations, an international Middle Atmosphere Program (MAP) has been launched and will be carried out for the next few years.

CONFERENCE FIELD TRIP: DEFENCE RESEARCH CENTRE, SALISBURY

A number of field trips were available for participants of the conference. I went on one such trip to the Defence Research Centre, Salisbury, just outside of Adelaide. During this tour, attended by some thirty people, a display of engineering support facilities and activities was inspected, rocket and gun propulsion work was described, and laser applications, including depth sounding were discussed and demonstrated.

The Defence Research Centre, Salisbury, in on 4¼ square miles of land and contains 1200 buildings, and employs some 3,000 people, including about 460 professionals. There are four major laboratories and the group visited three out of the four. Each laboratory is divided into divisions. The names of the laboratories, the names of the divisions, as well as the various topics being pursued in each division, follow:

- Electronics Research Laboratory

  Radar Division

    Microwave radar
    HF radar
    Antennas and propagation
    Real time computers (military applications)
    TV and display systems

  Electronic Warfare Division

    Electronic Warfare
    Ionospheric and tropospheric propagation
      (related to electronic warfare)

  Navigation and Surveillance Division

    Night vision techniques
    Infra-red techniques
    Laser applications
    Optics
    Navigation
    Central Computer

- Weapons Systems Research Laboratory

  Aeroballistics Division

    Missile flight dynamics
    Aerodynamics
    Fluid dynamics
    Ballistics

  Propulsion Division

    Propellants
    Rocket propulsion
    Gun propulsion

  Weapon Systems Division

    Guidance and control of weapons and remotely piloted vehicles
    Combat data systems
    Underwater detection systems

- Advanced Engineering Laboratory

  Communications and Electronic Engineering Division

      Defence Communications technology and networks
      Electronic Engineering Design techniques and systems
      Underwater Systems technology and instrumentation

  Mechanical Engineering and Workshops Division

    Mechanical Engineering Design (precision mechanisms and environmental design)
    Airborne Systems (structures and instrumentation development)
    Workshops (mechanical, electrical and electronic)
    Apprentice Training School
    Engineering and Technology Support Branch

      Quality Assurance (design, drafting and manufacture)
      Computer Aided Processes (design, drafting and manufacture)
      Drafting and Graphic Services (processes and standards)

Trials Resources Laboratory

Trials at Woomera
Trials away from Woomera
Analysis of Service exercises

Some items which were shown to the group include:

An 8-mm special-purpose camera which records in-flight behavior of free-flight projectiles. It is designed so that it can be launched with the projectiles and take a movie film of their flight. The camera is aerodynamically stabilized prior to filming by a spring-actuated set of flip-out fins attached to the tail unit. At the completion of the mission, the tail unit is jettisoned and a small parachute is deployed to facilitate recovery of the camera.
Thin Walled Sand Castings. This was a Mg alloy case casting for an experimental laser range finder. Some parts of the casting were only 2-3 mm thick.
Thin Film Fabrication. Examples of the bonding of chip components and packaging of thick-film hybrid microelectronics devices were shown, as well as screen printing of thick-film circuits and resistor trimming.
A film on rocket motors developed by the Propulsion Division.
Lasers. It has been 12 years since an airborne laser has been used as an altimeter by reflection of pulses from ground. One can obtain the profile of the ground and the results displayed. The effects of barometric pressure must be corrected for Argon ion cw lasers have been used in a national mapping program as well as an army mapping program. The division is assisting Indonesia with laser mapping equipment. Nd YAG lasers (532 nm green beam) are being used to measure the depth of the ocean. Two beams are used for this purpose. One is a reflection from the surface of the ocean and the other is the reflection from the ocean bottom.

A very favorable impression was made by the quality of the work and the professional people employed. The laboratory directors report directly to the Chief Defence Scientist of the Department of Defence, and as such each laboratory is quite autonomous.

The Japan Times of July 30, 1980, carried an article stating that a consortium of five Japanese firms will build two experimental coal liquefaction facilities in Australia under an agreement reached with the state of Victoria. Starting in 1981, the consortium will design and construct an experimental pilot plant capable of liquifying 50 tons of coal a day. Sometime during the second half of the 1980s, it is planned to construct a demonstration plant capable of producing 15,000 barrels of gasoline, naphtha, and fuel oil from 5,000 tons of coal a day. The work is to be carried out by the Nippon Brown Coal Liquefaction Company, an organization owned by the Asian Oil Company, Idemitsu Kosan, Kobe Steel, Mitsubishi Chemical Industries, and Nissho Iwai Corporation. The state of Victoria will provide the brown coal, various infrastructures, personnel, and the plant sites about 160 km from Melbourne.

The experimental pilot plant is scheduled to be completed during 1982 and begin synthetic fuel "production" in early 1983. The results of the pilot plant experiments will be used for designing the demonstration plant.

It has also been announced that Japan, the United States, and West Germany have signed a contract (July 1980) to launch a large coal liquefaction project. The three countries will build a demonstration plant capable of liquefying 6,000 tons of coal daily in West Virginia. The plant will be completed in 1984.

FIVE DEPARTMENTS OF PHYSICS IN NEW ZEALAND

Leon H. Fisher

INTRODUCTION

There are six universities in New Zealand and they are all publicly supported. This is a report of visits to five of the six departments of physics in these universities, and is designed to give an overview of physics activities. The report covers physics education and research at the University of Auckland (founded in 1863), the University of Waikato (founded in 1965), the Victoria University of Wellington (founded in 1899), all on North Island, and the University of Otago (founded in 1869), and the University of Canterbury (founded in 1873), both on South Island. These universities are in the cities of Auckland, Hamilton, Wellington, Dunedin, and Christchurch, respectively. Due to lack of time a visit was not made to Massey University, an institution about 50 years old, which had its origins as an agricultural school, and which is in the city of Palmerston North, North Island.

The population of New Zealand is about 3 million and the number of students enrolled in universities is about 45,000. This is two to three times the ratio of university students to population which exists in England.

In 1870, an institution called the "University of New Zealand" was formed as a purely examining body. It had no students, and no faculty. It was hoped that all degrees from institutions of higher education would be granted by the "University of New Zealand" rather than by the individual institution. The University of Otago agreed to do this in 1874, after having granted degrees for some years on its own. The University of Canterbury (then Canterbury College) also affiliated, as did Auckland in 1882, and Victoria in 1897. Until 1961, starting from the above dates, all degrees in New Zealand were indeed granted by the "University of New Zealand." However, in 1961, the universities were established or once again established as independent and degree-granting institutions. With the small size of the population at the time of the founding of the "University of New Zealand" and with the relative obscurity of the individual sites of some of the institutions in those days, it was thought that a degree from the "University of New Zealand" was preferable to one relating to a specific institution. The idea prevailed until 19 years ago.

Academic staff in New Zealand (as well as in Australia) are paid for a twelve-month year, and do not have to scurry around looking for summer employment to make ends meet the way many American faculty members do. Those who wish to learn more about the organization of scientific research in New Zealand should read "Scientific Research in New Zealand," by A. R. Poletti, published in Nature, *246*, 257 (1973).

All physics departments in New Zealand provide graduate work, and all grant the Ph.D. degree.

Of the five universities visited, only the University of Auckland and the University of Canterbury have engineering programs. Brief comments on physics activities at the University of Canterbury and Victoria University of Wellington appear in this Bulletin *4* (2), 21-22 (1979).

UNIVERSITY OF AUCKLAND

The city of Auckland has a population of about 800,000 and is the largest city in New Zealand. The University of Auckland has an enrollment of about 11,000 and is the largest university in New Zealand. The city of Auckland contains about one quarter of the population of New Zealand and the University of Auckland enrolls about one quarter of all the university students in New Zealand.

The University of Auckland had its origins in the Auckland University College. It was not until 1958 that the institution became known as the University of Auckland. One of the six original chairs established in 1863 was a combined one in physics and chemistry. (Lectures in engineering did not start until 1900, and it was not until 1906 that a School of

Engineering was established). In 1913, the combined chair of physics and chemistry was expanded to one in physics and another in chemistry. In 1962, a chair of theoretical physics within the physics department was established as a second chair in physics.

There are 24 members in the physics department at the University of Auckland. Of the 24, four are professors, six are associate professors, eleven are senior lecturers, one is a senior lecturer in biophysics, one is a senior lecturer in physico-chemistry, and one is a senior research fellow. Of these, 16 received their master's degrees from the "University of New Zealand," and five received their Ph.D. from the same institution. Of these faculty members, four received both the master's and doctor's degree from the "University of New Zealand." Presumably, these degrees are for work done at the University of Auckland, but one cannot be certain. The chairman of the department, A. C. Kibblewhite, who himself has the M.Sc. degree from "New Zealand" (and whose Ph.D. was obtained at Birmingham), feels that it is an ingrown department and that "people don't come from any place else." Actually, the doctoral degrees of the faculty obtained from other institutions than the "University of New Zealand" include the University of Birmingham (2), the University of Edinburgh (1), the University of Melbourne (1), the University of Manchester (3), MIT (1), Oxford University (3), and University of Surrey (1). The department does not seem ingrown to me.

Graduate students in physics at the University of Auckland must obtain a master's degree before proceeding to the the Ph.D. program. A thesis is required for the master's degree. It is a two-year program. About 20 master's degree and one Ph.D. are granted every year.

The enrollment in both undergraduate and graduate work in physics has been increasing in recent years. There is evidence of a renewed interest in the physical sciences. Several major international companies have sent recruiting teams to New Zealand (and Australia) for graduates trained in various aspects of physics. In 1980, over 650 students will be doing undergraduate work in physics at Auckland.

The major fields of research within the department include nuclear physics, biophysics, quantum optics, elementary particle physics, geophysics, and electrophysics. The various research fields are now discussed.

NUCLEAR PHYSICS (P. H. Barker, R. Garrett, D. J. Hooton, H. Naylor, A. R. Poletti, A. P. Stamp, and R. E. White)

The principal instrument in nuclear physics at Auckland is a 4-MeV Van de Graaff generator which was built at the university. It is called AURA II (Auckland University Accelerator II). (AURA I was a Cockroft-Walton accelerator.) The accelerator has been converted into a tandem machine in which negative ions can be accelerated, stripped in a thin carbon foil, the resulting positive ions being turned through 180° with a magnetic field of up to 14 kG and accelerated in the opposite direction. The following negative ions have been accelerated: H^-, He^-, Li^-, C^-, F^-, and O^- The F^- can give rise to F^{+6} ions of about 28 MeV, and O^- can give rise to O^{+4}. The turning magnet is in the terminal. The length of the insulating column is 7 feet, and a gas mixture of N_2 and CO_2 and about 5% SF_6 at a total pressure of about 12 atmospheres is used for high-voltage insulation. The voltage of the machine is accurately stabilized, using signals from the emerging beam in its passage through an analyzing magnet. The voltage can be controlled to 100 volts in 4 MeV. It is hoped that the accelerator will be used in the new method of radioactive dating by accelerating C^{14} from samples and distinguishing it from N^{14} by the rate of energy loss through gases. It is interesting to note that a 25-MeV tandem Van de Graaff accelerator, capable of giving 50-MeV protons, was installed at the Oak Ridge National Laboratory in 1979.

The principal use of the machine is to make threshold energy measurements. Last year three absolute measurements were made. For one of these, the $^{27}Al(p,\gamma)$ resonance at 992 keV was determined as having an absolute energy of 991, 910 + 30 eV. The small uncertainty of 30 eV makes this one of the most accurately-measured reaction energies.

On the theoretical side, a study of the effect of orthogonality on antisymmetrization in the strong coupling model of nuclear transfer reactions has been made. It was shown that both effects could be combined into a unified theory. The theory has been applied to the reaction $^{12}C(d,p)^{13}C^*$. Work is being carried out on the sensitivity of inelastically-scattered electrons to the nuclear convection currents. The initial study involves excitation of the collective states in ^{20}Ne and the determination of the nuclear convection currents using the cranked Hartree-Fock theory.

The group publishes a great many papers. Some of the titles of 1979 publications follow:

"Gamma ray studies using a solid argon target: properties of states in ^{40}K and ^{40}Ar."
"A 14 MeV polarized neutron facility,"
"Analysis of ^{36}Cl in environmental water samples using an electrostatic accelerator."
"Investigation of charge symmetry violation in the mirror reactions $^{2}H(d,p)^{3}H$ and $^{2}H(d,n)^{3}He$."
"High spin states in ^{210}Rn: the effect of the neutron holes on the four-proton configurations."
"Precision Doppler shift attenuation lifetime measurements in ^{28}Si and ^{31} p,"
"Lifetimes of excited states in ^{54}Mn and ^{53}Cr."
"The $^{27}Al(p,n)^{27}Si$ threshold energy for accelerator calibration."
"Analyzing power measurements in deuteron-proton elastic scattering."
"The $^{14}N(p,n)^{14}O$ threshold energy and the Q-value for the superallowed Fermi decay $^{14}O(\beta^{+})^{14}N$," and "The $^{35}Ar(\beta^{+})^{35}Cl$ decay and the anomalous Cabbibo angle."

As can be seen from some of the above titles, the machine is being used for measurements for understanding the weak interaction.

The group was forced to shut down their polarized ion source, which had been running for six years.

BIOPHYSICS AND QUANTUM OPTICS (E. R. Collins and J. D. Harvey)

Work is being carried out on light scattering from motile bull spermatozoa using laser radiation. Theoretical investigations of light scattering from large particles are being carried out. Other areas of research are electron microscopic studies of agarose gels, image analysis of electron micrographs, and studies of the generation time distribution of microorganisms. Construction of a pulsed U. V. laser was started and it is planned to study laser-induced fluorescence.

In the scattering of laser light by motile spermatozoa, it has been shown that the spectrum of the scattered light is dominated by the nontranslational aspects of the swimming motion. A large experiment is under way to correlate the light scattering data from spermatozoa samples with the conception rates achieved in the artificial insemination program of the New Zealand Dairy Board.

ELEMENTARY PARTICLE PHYSICS (P. C. M. Yock)

Particle detectors were set up at sea level, on the Fox Glacier, and at the South Pole, to search for highly-charged subnucleonic particles in the cosmic radiation. Over the past few years, measurements of slow cosmic ray particles have been carried out.

GEOPHYSICS AND ELECTROPHYSICS (G. E. J. Bold, R. J. Clegg, J. B. Earnshaw, R. F. Keam, A. C. Kibblewhite, C. D. Stow, C. T. Tindle, Z. C. Tan).

Wind energy studies are being carried out to discover the relationship between predicted wind energy and theoretical energy which can be extracted by a rotor.

A long-term survey of lightning activity in the Auckland region has continued and is due for completion in 1980.

Development of instrumentation for the measurement of properties of rain, such as drop size and charge distributions, and precipitation variations in space and time have been carried out throughout 1979 in preparation for 1980 field studies. Studies of the fluid flow accompanying the impact of water drops with unyielding surfaces have also been initiated.

Magnetic micropulsations are being analyzed with data from recording stations at Campbell Island and Scott Base in Antarctica.

A. C. Kibblewhite is the head of the department. He is a marine geophysicist and has carried out extensive studies on the propagation of underwater sound. He is an experimentalist and is interested in the passive applications of acoustics and most of his work involves long-range transmission at low frequency around the Pacific. A meeting was held in July, 1979, in Auckland which was a satellite meeting of the International Conference on Acoustics in Sydney on passive and active sonar scattering.

There is now a United States/New Zealand Co-operative Science Program in nondefense areas. There is scientific cooperation in the energy, and in the nonenergy field. C. J. Maiden, the vice chancellor of the University of Auckland, is the New Zealand executive for the engineering component of this bilateral work. The nonenergy component is administered by Kibblewhite. At the moment, the dominant area of cooperation is in the marine sciences. This work, which is theoretical and experimental, tends to be field-oriented and is designed to understand acoustic backgrounds and to identify the key phenomena involved. (Dr. Allan Milsap, National Science Foundation, Washington, is the program manager of this cooperative program)

A paleomagnetic program is being carried out with volcanic rocks in Northland.

In the field of electrophysics, work ranges from signal processing of geophysical data to medical image processing and astrophysics instrumentation.

UNIVERSITY OF WAIKATO

The University of Waikato is in Hamilton, New Zealand. Hamilton is a city of about 153,000 inhabitants and is about 120 km south of Auckland. As mentioned in the introduction, the university is very new, having been opened in 1965. The School of Science was established in 1970. The university presently enrolls about 3000 students.

There are five science departments at the University of Waikato: biology, chemistry, earth sciences, mathematics-computer science, and physics. There are about 600 undergraduates in science and about 130 graduates enrolled in the master's or doctor's programs in science.

There are two undergraduate degrees in physics, the B.Sc., a three-year degree, and the B.Sc. (Tech), a four-year degree. The B.Sc. (Tech) requires twelve months of work outside the university as part of the four-year training. A report on this work must be submitted for the degree.[1] There are about 150 first-year physics majors, 50 in the second year, and 35 in the third year.

The master's degree in physics requires two years of work and includes courses (called papers) and a thesis.[2] The student must take four one-semester courses selected from such topics as statistical mechanics, quantum mechanics, advanced quantum theory, fluctuations, irreversible thermodynamics, and solid-state physics. According to the chairman, all courses are taught at the "research level." There are no courses offered or required for the doctor's degree. For experimental work, four or five years are generally necessary to complete the doctor's program.[3]

At present, 14 students are enrolled in the master's program in physics. (There are actually two master degrees, the M.Sc. and the M.Phil. I do not know the difference between these two degrees.) Four students are continuing their studies in the doctor's program, two are pursuing work in biophysics, one is working in plasma physics, and the other is pursuing theoretical physics. About 20% of the graduate students in physics come from other institutions.

There are eight faculty members in the physics department, including one professor. Ranks of reader (associate professor), senior lecturer (assistant professor), lecturer, junior lecturer, and demonstrators or tutors also exist.

The faculty of the physics department and their research interests follow.

B. S. Liley is the head of the department. He is a theoretical and experimental plasma physicist. He came to the University of Waikato from the Department of Engineering Physics of the Research School of Physical Science of the Australian National University in Canberra. While at Canberra, Liley built what may have been the first Tokamak (or Tokamak-like) device in the Western world. (Tokamaks at the Australian National University are designated as LT-1, LT-2, LT-3, etc., LT standing for Liley torus). During my subsequent travels in Australia, I found Liley's name to be a household word among physicists; they bemoaned the great loss to Australian plasma physics in the move of Liley to New Zealand. As recently as 1979, a paper "Ion Heating in the LT-3 Tokamak" was coauthored by Liley and Bydder (also from Waikato) and A. H. Morton, from the Department of Engineering Physics, Australian National University. Liley is a man of boundless enthusiasm and great love for physics and research. In addition, he is deeply interested in, concerned with, and committed to, undergraduate education in physics. The laboratories which he has organized, planned, and implemented for undergraduates are nothing short of miraculous. Any undergraduate student studying physics at Waikato is indeed fortunate.

There are three main areas of work being pursued in plasma physics at Waikato.

The first is the plasma torch which operates at atmospheric pressure in argon and is an rf induction discharge. The discharge operates at 27 MHz and at 1 kW power. There is an axial magnetic field of 500 G. Other material, such as nitrogen or metal halides, are injected into the torch. The uses for the torch would be as a spectroscopic source and the injected material might be rich in metastables. The metastables could be used as lasing material with appropriate resonators (the torch would be used as a pumping device). The electron and ion temperatures in the torch range from 7,000°K to 10,000°K. The plasma is about 0.1% ionized, giving an electron-ion density of about $10^{16}/cm^3$.

The second interest of Liley in plasma physics is in the solution of the 19-moment Boltzmann equation. Liley is trying to understand from this all possible kinds of instabilities in plasmas. He is interested in obtaining heat flow, particle flow, and energy-radiation transport. He is interested in neoclassical diffusion due to magnetic fields.

The third interest in plasma physics is in the construction of a linear Tokamak device in order to study anomalous diffusion and disruptions. This machine is being built now. It will have a magnetic field region of 1.6 m length and an electrode separation of about 1.5 m. The diameter of the discharge vessel will be 20 cm and it will consist of four insulated metal sections. The magnetic field will have a maximum value of 1 T, and the maximum plasma current will be 22,000 A and will have a 5 ms duration. The anticipated electron density with H_2 is 10^{19} to $10^{20} m^{-3}$; the anticipated electron temperature will be somewhat below 100 eV; and the anticipated ion temperature, using H_2, will be between 50 and 500 eV. The mirror ratio will typically be about 1.3. The purpose of this linear Tokamak system is to study the effect of magnetic field curvature in the containment of hot plasmas.

E. L. Bydder works in the same general areas of plasma physics as does Liley. Together, they are studying longitudinal waves in plasmas theoretically. Bydder designed the linear plasma machine described above for studying transport and instability processes. He works on the development of plasma diagnostic instruments using neutral beams. He also works on the plasma torch described above. Other activities include the development of solid-state detectors for use in nuclear medicine, polymerization and cross-linking induced by electron bombardment of hydrocarbons and certain polymers, and the effect of hydrostatic pressure on lakeweed growth.

R. O. Dillon, an American, received his Ph.D. from the University of Maryland, and joined the University of Waikato in 1979. He is an experimental solid-state physicist who works on thin films. He came to Waikato with an impressive record of publications in solid-state physics. At Waikato, he has carried out design studies on an electron beam evaporation system to be used in the production of amorphous films.

C. W. Gardiner carries out theoretical studies on stochastic processes in chemical and quantum systems.

R. J. Osborne is active in physics education.

R. A. Sherlock is an experimental biophysicist. He is working on the membrane and developmental properties of the marine alga *Acetabularia mediterranea*, on electronic instrumentation for use in biophysics research, and on a stereoscopic x-ray technique for the accurate measurement of developmental abnormalities in sheep jaws. He is carrying out theoretical investigations of large networks of binary elements, as well as working with D. F. Walls, also of Waikato, and J. D. Harvey of the University of Auckland on the use of laser light in making assays of bull spermatazoa. Sherlock has published extensively. The titles of some of his recent publications follow:

- "A method of precision position determination using x-ray stereograph," *Physics in Medicine and Biology*,
- "Criticism of the article 'movement of the sacroiliac joint'," *Clinical Orthopaedics and Related Research*,
- "The behaviour of large networks of binary elements: possible models of brain function," *Proceedings of the Australian Society of Biophysics*,
- "Analysis of the behaviour of Kauffman binary networks I: State space description and distribution of limit cycle lengths, and, II: The state cycle fraction for networks of different connectivities," *Bulletin of Mathematical Biology*, and
- "A pulse height analyser for displaying Coulter counter particle size distributions," *IEEE Transactions on Biomedical Engineering*. (The Coulter counter is widely used in medical and biological laboratories for counting and sizing cells and microorganisms, and this paper describes how useful information about the distribution of particle

sizes present can be obtained by feeding the pulse train produced by the counted particles into a 100-channel pulse height analyzer.)

Sherlock has also been extremely active in the field of phonons in liquid and solid helium and in low-temperature phenomena in general.

D. F. Walls has recently published a number of theoretical papers on quantum optics and the statistical mechanics of nonequilibrium phenomena. He has also initiated a collaborative program with the experimental laser spectroscopy group at the University of Otago.

The titles of some of his recent publications follow:

- "Evidence for the quantum nature of light." (In this paper, recent theoretical predictions and experimental observations of photon antibunching in resonance fluorescence from a two-level atom are reviewed.)
- "Bistability and photon antibunching in sub/second harmonic generation." (In this paper, the nonlinear interaction between a fundamental and second harmonic wave inside a Fabry-Perot cavity, where both modes are driven by a coherent driving field with a definite phase is analyzed. It is found that, under certain experimentally accessible conditions, bistable operation is possible. Also photon antibunching in the steady state may occur.)
- "A simple field theoretic description of photon interference." (In this paper, a description of photon interference experiments of the Young double-slit type is given, using the techniques of quantum-field theory.)
- "Nonequilibrium phase transitions in cooperative atomic systems."

Walls was also a coauthor of a paper with C. W. Gardiner on work mentioned under Gardiner's name, stochastic models of first-order nonequilibrium phase transitions in chemical reactions.

It is my opinion that the level of research, the breadth and quality of it, for such a small department so recently organized, is remarkable. I think that Liley deserves an enormous amount of credit for the spirit and vitality of the department.

As a final comment, mention may be made of The Second New Zealand Summer School in Laser Physics held at the University of Waikato 21-26 January 1980. This consisted of a series of lectures at a level suitable for graduate students and research workers on

- "Stabilized dye lasers and ultrahigh resolution spectroscopy,"
- "Multiphoton ionization of atoms and molecules,"
- "Development of new laser systems,"
- "Coherent interaction of atoms with intense light field,"
- "Topics in quantum optics: laser theory, nonlinear Optics, photon statistics, resonance fluorescence, Optical bistability,"
- "Collisional effects in resonant light scattering," and
- "applications of photon correlation spectroscopy."

Lecturers included R. Bullough, University of Manchester; J. Cooper, University of Colorado; J. Dodd, University of Otago; M. Ducloy, University of Paris; J. Eberly, University of Rochester; S. Kielich, University of Poznana; P. Knight, University of London; P. Meystre, Max-Planck Institute, Munich; D. Pegg, Griffith University; J. Piper, Macquarie University; A. Schenzle, University of Essen; H. Walther, University of Munich; and P. Zoller, University of Innsbruck.

VICTORIA UNIVERSITY OF WELLINGTON

Victoria University of Wellington is in Wellington, the capital of New Zealand. Wellington is the second largest city in New Zealand, and the metropolitan area of Wellington has a population of about 350,000. The university was founded in 1899, 34 years after Wellington became the capital of New Zealand, and 36 years after the founding of Auckland University College (which was to become the University of Auckland). There are presently about 7000 students and about 400 faculty at Victoria University. The present scientific academic disciplines include antarctic research (the university has an antarctic research center), biochemistry, botany, chemistry, geology, geophysics, information science, mathematics, physics, statistics, operations research, and zoology. Whereas the University of Auckland has an engineering

program, Victoria University does not. There are about 1200 students enrolled in scientific disciplines at Victoria University.

The physics department is housed in Hunter Hall, a venerable structure which has been designated as an earthquake risk and one not suitable at all for a modern department of physics. The housing of the physics department at Victoria is far below the standard of the other four physics department buildings which I visited in New Zealand.

There are two undergraduate degrees in physics, one a B.Sc. which is a three-year program, and the other a B.Sc. with honors which is a four-year program. An unusual program introduced two years ago is a diploma course in applied science (physics), which aims to introduce physics graduates to the industrial environment and to show how physics concepts may be applied in the development of new technology. The master's and doctor's degree are also offered by the physics department. An average of about four students per year obtain the master's degree in physics and about one student per year completes the doctor's course.

The department has three main research interests: condensed matter-solid-state physics, low-energy nuclear phsyics, and geophysics, including solid-earth geophysics, oceanography, geomagnetism, and continental drift. The low-energy nuclear physics activity includes atmospheric radioactivity, and the use of a 600-keV Van de Graaff machine purchased from the High Voltage Engineering Corporation to carry out ion implantation work. I do not think there is any activity in what is conventionally known as low-energy nuclear physics, but I am using the term which is used at Victoria to describe their work.

There are fifteen members in the physics faculty consisting of four professors, one associate professor, two readers, and eight senior lecturers. There are also three junior lecturers and two honorary lecturers.

We now list the faculty with their research interests and activities.

D. Beaglehole is a solid-state-condensed matter physicist. He is carrying out studies of the thickness of liquid surfaces, especially near the critical point, using optical techniques and surface tension measurements. His work complements the theoretical work of J. P. Lekner (see below) on the surface properties of classical and quantum liquids. Near the critical point, the surface may be only two atoms thick; normally a layer 500 atoms thick is required to establish the properties of a liquid surface. The optical studies are carried out by using an ellipsometer to measure the coefficient of ellipticity at surface of liquids and solids. Some work on the water layer on the surface of ice below 0°C was carried out in collaboration with Dr. Nason, a visitor to the department in 1979, and was reported at the International Conference on Ellipsometry (Berkeley); subsequently, the work moved to studies of simple liquids, argon, and carbon tetrachloride, and binary liquid mixtures. The coefficient of ellipticity measures the adsorption at the interface. With H. J. Trodahl (see below), he has carried out far-infrared studies of amorphous semiconductors in order to understand the phonon properties of such materials. He has also studied the optical properties of Au, Cu, AuCu alloys as well as dilute CuNi alloys.

N. G. Chapman is a nuclear physicist and works on the radon content of the atmosphere.

D. A. Christoffel is a geophysicist. He has used a cryogenic magnetometer to carry out paleomagnetic measurements on sedimentary rocks throughout New Zealand to determine tectonic rotations. He carried out similar measurements on basalts from New Zealand to locate a paleomagnetic pole position for New Zealand about 90 million years ago. He has collected samples of sandstone from the Antarctic with the aim of establishing a history of the continentral drift of Antarctica. He is also analyzing geomagnetic depth sounding and magnetotelluric measurements in the North Island of New Zealand. A substantial electrical conductivity anomaly has been discovered which will require re-examination of the proposed tectonic evolution of New Zealand.

C. L. Cook is investigating the optical conductivity in disordered alloys theoretically.

F. F. Evison is a geophysicist. He is applying computer techniques to the study of New Zealand seismicity with special emphasis on multiple earthquake events. He has also studied the paths of tropical cyclones.

P. B. Johnson has studied the structure of microscopic gas bubbles which form in metals during ion irradiation with helium or with hydrogen isotopes. He has developed an *in situ* method, based on the scattering of laser light, to detect the onset of radiation-induced blistering in metals.

A. B. Kaiser has worked on the interpretation of very-low-frequency radio wave measurements as they are related to whistlers. He has carried out theoretical work on the effect of magnetic impurities on superconductivity, of weakly magnetic impurities on superconductivity, and of weakly magnetic impurities on the thermoelectric power of dilute transition metal alloys. His work includes the theoretical interpretation of measurements of differential reflectivity in the visible and in the infrared of metal alloys in terms of the density of states due to the impurity.

J. P. Lekner has made theoretical studies of light reflection and dielectric behavior at interfaces and at the surface of liquid helium. He has studied the theory of liquid vapor coexistence and recently investigated the giant dipole resonance in nuclei.

J. E. Morris is involved in material science and electronics. Recently he investigated the structure and properties of indium oxide and indium-tin oxide with a view to the development of a commercial deposition process for the production of indium-tin oxide films on polyester sheet. He has started a study of the application of microprocessors to engine control for fuel economy in automobiles. He is also working on modifications of tape recorders for blind students. Morris also works on thin and thick films.

J. E. A. Nixon works in applied electronics.

T. G. L. Shirtcliffe is interested in mixing phenomena in liquids. He has carried out laboratory studies on the mechanisms of exchange of salt and heat between neighboring water masses and has suggested a method for the transfer of salt and heat in the ocean. He has been leading a research team engaged in an oceanographic project aimed at a clearer understanding of mixing processes in the ocean. Specialized instruments were developed for such a study in northern New Zealand waters aboard the R. V. Tangaroa. The study concentrated on the mid-Tasman front, and a large quantity of data was collected from two traverses across this front.

D. J. Sullivan works on astronomical problems and, with H. J. Trodahl (see below), has investigated with millisecond precision timing the lunar occultations of stars. Some of this work was carried out at the Mt. John Observatory administered by the University of Canterbury.

H. J. Trodahl works with D. J. Sullivan (see above) on astronomical problems. He has also worked with D. Beaglehole (see above) on optical studies of amorphous semiconductors.

D. Walker is chairman of the department. He is a member of the University Grants Committee and of the New Zealand Atomic Energy Committee.

The department publishes about a dozen papers a year. It is surprising to find a department of this size in which there is no research activity in atomic physics, plasma physics, lasers, and nuclear physics (as commonly understood).

UNIVERSITY OF OTAGO

The University of Otago is in Dunedin, New Zealand. Dunedin has a population of 120,000 and is New Zealand's fifth largest city. The University of Otago is the most southerly university in the world. It was founded in 1869 and opened in 1871. There are about 7000 students at the university. Departments exist in the following scientific disciplines: biochemistry, botany, chemistry, geology, mathematics, microbiology, mineral technology, pharmacy, physics, physiology, and surveying. There is no engineering program.

There are two undergraduate degrees offered in physics, an ordinary B.Sc. obtainable in three years, and an honors B.Sc. obtainable in four years. Laboratory work is very strongly emphasized in the undergraduate program. For the ordinary B.Sc., one afternoon of laboratory work is required in the first year, two afternoons in the second year, and three afternoons in the third year. For the honors B.Sc., one afternoon of laboratory work is required in the first year, but three afternoons a week are required in both the second and the third year, and in the fourth year, the entire year is devoted to a full-time laboratory project. There is, thus, an unusually strong experimental orientation to the program. I visited the laboratories, and they are outstanding in the use of modern equipment and in carrying out modern experiments, especially in the field of optics, electrophysics, and nuclear physics. Experiments using gamma rays as well as on the Mossbauer effect are carried out by students. An NMR apparatus is also available as part of the regular program. This is a remarkable panoply of experimental opportunities for undergraduate students. In addition, strong emphasis is given

to the development by the students of techniques such as glass blowing and machine shop work. In the third year, every student must spend one afternoon a week in the student shops. The M.Sc. degree in physics can be completed in one year, but it usually takes longer. Only a thesis is required; no courses are offered or required. There are also no course requirements or offerings for the Ph.D. degree.

There are about fifteen faculty members in the department of physics. The chairman is J. N. Dodd, who has been at Otago since 1952. He received his master's degree from the University of New Zealand and his Ph.D. from the University of Birmingham. He spent a year recently at JILA (Joint Institute for Laboratory Astrophysics), Boulder. He seems to be a mixture of theorist and experimentalist and is deeply committed to, and involved in, quantum optics. Dodd has developed a strong group in this field at Otago. He has also strongly inspired the nature of the undergraduate program with its emphasis on experimental work. There have only been three other chairmen of the physics department at Otago since 1870. The first, John Shand, served for 44 years from 1870-1914, the second, Robert Jack, served 34 years from 1914 to 1948, and the third, Robert Nimmo, served for 20 years from 1948 to 1968. These three terms represent 98 years of service, a record probably unmatched anywhere.

There are three main fields of research at Otago, quantum optics, thin films, and ionospheric physics. The activities in these three fields at Otago are now discussed.

QUANTUM OPTICS

The faculty members involved in this field are:

F. Ansbacher, who received his undergraduate and graduate education at the University of London and who is a theoretician,

J. N. Dodd, who is described above,

W. J. Sandle, who received his master's degree from the University of New Zealand and his Ph.D. from the University of California at Berkeley and who is an experimentalist,

D. M. Warrington, who received his master's degree at Otago and his Ph.D. at Oxford, and who is a theorist, and

R. Ballagh, a young theoretical physicist with a Ph.D. from the University of Colorado, who has just joined the group to spend an extended period of time at Otago.

Dodd has an extensive history in quantum optics. Two years ago, he coauthored a review paper with G. W. Series entitled "Time-resolved fluorescence spectroscopy." This title gives a pretty good idea of the interests and activities of the group at Otago. Dodd and Warrington observed modulation in fluorescent light from atoms excited by a pulse of resonance radiation as early as 1964. In 1970, Dodd and Sandle observed transients in the intensity of fluorescence of mercury when a steady magnetic field was suddenly switched on. In 1972, Sandle with J. A. Piper (now of Macquarie University in Australia) investigated the effect of resonant collisions on the lifetime of the 6^3P_1 state in mercury. In general, the group is interested in the kind of information that can be obtained about atoms from measurements of time variations with micro- or nano-second resolution of the intensity of fluorescent light from an ensemble. It is assumed that all the atoms whose fluorescence is to be observed will have been prepared in the same way at the same time, to within the desired time resolution of the experiment.

Sandle presented a lecture entitled "Experiments on optical bistability" at the Second New Zealand Summer School on Laser Physics held in January, 1980, at the University of Waikato in Hamilton. The experimental work reported was carried out at JILA in collaboration with A. Gallagher, and the analysis of the data was made in collaboration with Warrington. Optical bistability was observed by placing sodium vapor inside a Fabry-Perot optical cavity, and irradiating the cavity with a cw dye laser mode matched to the optical cavity. The laser frequency is detuned from both the peak atomic absorption and the peak cavity resonance. The laser frequency is slowly swept through the Fabry-Perot cavity profiles while keeping the laser intensity constant. The optical bistability observed was interpreted in terms of a constant field two-level model. This model provides a satisfactory phenomenological explanation for the shape of the bi-

stability profiles, but fails to account quantitatively for the observed phenomena. This effect requires a non-linear absorber and appropriate optical feed back. The experiments are related to self-induced transparency.

There is interest in the group in studying the effect of collisions on coherence decay.

THIN FILMS

The research in thin films at Otago is directed by I. J. Hodgkinson. He received all of his education at the University of Otago. He has available an elaborate Edwards 30-cm coating plant in which the normal source to substrate distance is 28 cm. Films with a predetermined refractive index and thickness can be fabricated. In practice, a given refractive index can be obtained by controlling the oxygen pressure and deposition rate during the period of deposition.

The principal interest in thin films is in the effect of ultraviolet irradiation on the properties of silicon oxide films. In 1963, workers elsewhere discovered that the ultraviolet absorptance of silicon oxide films could be decreased considerably by exposing the films to intense ultraviolet radiation. During the course of these investigations, it was noticed that both the refractive index and the thickness of the films changed. An increase in thickness of film was accompanied by a complementary decrease in refractive index. It is this effect which has been exhaustively investigated by Hodgkinson while on study leave at the Division of Optical Metrology, National Physical Laboratory, England. Work of this nature is being pursued at Otago.

IONOSPHERIC PHYSICS

Studies in ionospheric physics at Otago are being carried on by L. E. S. Amon, R. L. Dowden, and N. R. Thomson. Amon and Thomson received their education at Otago; Dowden received his undergraduate training at the University of Sydney and his graduate training at the University of Tasmania.

The group is especially interested in the properties of whistlers and the propagation of electromagnetic waves by the earth's magnetosphere. The group participated in the Canadian ISIS program (International Satellite Ionospheric Sonde). There is equipment for studying whistlers on the campus in Dunedin, at Lauder, New Zealand, in the center of Otago province, and on Campbell Island, about 400 miles from Dunedin. The Dunedin magnetic field line goes out to three earth radii, whereas that from Campbell Island goes out to four earth radii. Campbell Island field lines are just outside the plasma pause and, thus, it is a good station for studying aurora and VLF effects. The Lauder station is not used to carry out auroral studies. The Otago observations on whistlers are in the frequency range from 3 to 30 kHz, and frequency spectrum measurements of whistlers are being made. The whistlers observed in Dunedin originate in Alaska and arrive 1 second after the spheric (the electromagnetic energy which originates in a lightning discharge, and which travels in the earth-ionospheric wave guide system) is initiated. Signals occur once every five days on the average, having travelled over about one third of the earth. From the measurements, the minimum magnetic field strength and the integrated electron density can be obtained.

The group has recently published three papers on whistlers. The first two involve simultaneous ground and satellite reception of whistlers. The third paper is entitled "Micropulsations observed by whistler-mode transmissions," and correlates Doppler shifts of a 6.6 kHz signal from a transportable VLF transmitter in Alaska as a function of time, as received at Dunedin, with observed magnetic field pulsations at Dunedin. There is strong correlation.

N. R. Thomson coauthored a paper, in 1978, in *Radio Science* entitled "STARE: a new radar auroral backscatter experiment in northern Scandinavia."

OTHER RESEARCH ACTIVITIES

Several faculty members are concerned with the harnessing of wind energy in Otago province, and one faculty member is carrying out research on heat pumps.

The 1980 catalog of the University of Otago lists seven journal articles, one chapter in a book, and two New Zealand Energy Research and Development Committee reports (on wind energy in Otago).

UNIVERSITY OF CANTERBURY

Christchurch, the city in which the University of Canterbury is located, has a population of over 300,000. The University of Canterbury was established as Canterbury College in 1873. In 1935, the institution became Canterbury University College and, in 1957, the title was changed to its present one, the University of Canterbury.

Until 1960, the university was located near the center of Christchurch on a campus consisting chiefly of buildings constructed before 1924. Between 1960 and 1974, the university moved to a new site at Ilam, about 5 km to the west of the city center. The buildings of the new campus are not nearly as interesting or as attractive as those of the old campus. Good use is being made of the old campus for civic affairs. There are about 8000 students enrolled in the university.

Science departments at the university include botany, chemical engineering, chemistry, civil engineering, computer science, geology, mathematics, mechanical engineering, physics, and zoology.

There are two undergraduate degrees in physics, one a three-year degree which is considered by the department to be a "weak" degree, and which is taken by those who want to be teachers (alas), and a four-year honors degree which is considered to be a professional degree. The two programs are completely separate, with different courses being offered. Upon completion of the honors degree, some students go to places like Cal Tech and MIT for graduate work. I was told that the admission standards for undergraduates are comparable to those of the University of Colorado. There is a great dispersion in the abilities of the students.

Graduate enrollment in physics consists of about ten in the master's program and about 15 in the Ph.D. program. About two or three Ph.D.'s a year are produced.

There are about 23 faculty members in the physics department: three professors, five readers, eleven senior lecturers, and four lecturers. The department has a reputation for being "theoretical" in contrast to Otago which is considered to be primarily "experimental."

There are four major research interests in the department: theoretical physics, ionospheric and space physics, solid-state physics, and astronomy. These activities will now be discussed.

THEORETICAL PHYSICS

P. H. Butler works on algebraic and group theoretic problems arising in applications of many-body problems.

W. L. Jones works on analysis of higher order conserved quantities in specific fluid flow problems. He is interested in wave-wave interactions in the terrestrial and solar atmospheres.

A. G. McLellan, who is the chairman of the department, is working on the thermodynamics of crystalline materials under nonhydrostatic stress, and on the thermodynamic stability of elastic materials. He is especially interested in limiting thermodynamic relations at phase transitions and in group theoretic problems related to thermodynamic functions of crystals.

W. R. Moreau is carrying out research in the application of finite-difference perturbation theory to atoms and molecules as well as in multichannel scattering theory.

A. W. Ross studies solitons in two and three dimensions. He is concerned with energy transport and the theory of convection.

B. G. Wybourne is interested in the applications of group theory to physical problems such as the theory of complex spectra and spectroscopic properties of lanthanides and actinides, as well as to exceptional groups in particle physics.

IONOSPHERIC AND SPACE PHYSICS (W. J. Baggaley, R. G. T. Bennett, G. J. Fraser, H. A. von Biel)

The topics being investigated are atmospheric ozone, D-region structure, characteristics of winds in the 60-100 km range, airglow, meteoric phenomena within the earth's atmosphere, and the characteristics of meteoroids in space.

The work is concentrated on the dynamics and transport processes in the middle atmosphere (10-100 km). The wind field, which is made up of the prevailing wind, planetary waves, atmospheric tides, and gravity waves produces important variations in the concentration of minor constituents such as ozone and nitric oxide. The diffraction and scattering of electromagnetic waves by ionospheric irregularities is also being studied, and a radio-frequency polarimeter has been developed for the D-region. Meteors are studied partly for their own interest, for example, in the study of the mass distribution of meteoroids in the solar system; and partly as a tool to yield information about the neutral wind in the 80-to-110-km region by Doppler echo observations and about the interaction between hot meteoric constituents and atmospheric gases.

The group has a field station at Birdlings Flat. This station was established in 1961. It is 50 km by road from Christchurch. I was able to visit this field station. The equipment includes 2.4 MHz and 4.6 MHz transmitters (80 kW peak pulse power) and a variety of arrays for transmitting and receiving, some polarized.

During midday, meteor counts amount to a few per hour. At night, there are several hundred per hour. The meteors being detected are mostly the size of grains.

Especial interest exists in the comparison of the wind velocity deduced from Doppler shifts in the D layer and from similar data from the overdense plasmas produced by the meteors. There is a high noise level in these measurements due to atmospheric turbulence.

SOLID STATE PHYSICS (J. A. Campbell, C. N. Hooker, G. D. Jones, V. H. McCann, T. J. Seed, G. E. Stedman)

The research is principally directed to the study of ionic crystals, often using transition metal, or lanthanide ions as probes for the investigation of the host crystals. Other materials such as semiconductors are also being studied.

Some of the physical phenomena being investigated include the vibrational mode frequencies of crystals, ligand field spectroscopy (the energy levels of paramagnetic ions introduced as impurities into crystals), the effect of changing the environment of impurity ions by applying perturbations such as Zeeman splitting or mechanical strain, the effect of lattice vibrations on the electronic levels of impurity ions (electron-phonon interaction), the exchange interaction between paramagnetic ions, and the scattering of light by ionic crystals (Raman and resonant Raman effect).

The department has a crystal-growing facility consisting of a 40-kW rf furnace. The optical equipment covers the ultraviolet, visible and infrared regions, a 15-W argon ion and dye laser Raman spectrometer, 9- and 35-GHz EPR spectrometers, a Mossbauer spectrometer, a thermal conductivity apparatus, liquid helium, and cryogenic facilities, including superconducting magnets for fields up to 6 T.

ASTRONOMY (N. A. Doughty, K. H. Fera, J. B. Hearnshaw)

Astronomy became an active research interest in the department, in 1965, when the Universities of Canterbury and Pennsylvania set up Mount John Observatory at Lake Tekapo. (It takes about six hours of driving to get to Mount John from Christchurch, and time did not permit a visit). The University of Pennsylvania provided a 61-cm Optical Craftsmen telescope in 1969, also the three astrograph cameras (10, 12.5 and 26 cm, f/7) with which the Canterbury Sky Survey, a major 16th magnitude photographic survey, was completed in 1972. The University of Florida joined the partnership in 1970.

In 1975, the physics department bought a 61-cm Boller and Chivens telescope for Mount John. This has been used extensively for photographic monitoring of southern quasars with the image tube camera. In 1976, stellar spectroscopy was initiated with a medium-dispersion spectrograph (reaching 9th magnitude stars at 60Å/mm) from the University of Florida. An echelle spectrograph was constructed in the department, in 1976, and is being used for high dispersion (2Å/mm) spectra of bright stars (down to 6.0 magnitude with a one-stage image tube).

Research interests have centered primarily on close and eclipsing binary stars. At present, there are studies underway in stellar abundance analysis and in the analysis of atmospheric parameters of stars using model atmospheres.

Unfortunately, just recently, both the University of Pennsylvania and the University of Florida have withdrawn support from the observatory, and the installation is presently being run by the University of Canterbury on its own. Up to recently, both American universities had sent students and staff to work at the observatory.

REFERENCE NOTES

[1] Students are paid by their hosts during the twelve-month period. During the current economic recession, much time-consuming effort is needed to find employers willing to take students for the industrial experience part of their course. So far, the department has just managed to obtain placements for all students in the increasingly-popular B.Sc. (Tech) program but it is not clear that they will be able to continue to do so.

The following are the titles of some of the reports submitted during the last year:

"Refractor calibration," New Zealand Forest Products, Tokoraa;

"An interface for data logging from a dairy into a minicomputer," Ruakura Agricultural Research Station, Hamilton;

- "Computer analysis of undersea acoustic propagation," Defense Scientific Establishment, Auckland;
- "Construction of a timer/counter," Ruakura Agricultural Research Station, Hamilton;
- "Stress studies using photo-elasticity," New Zealand Insulators Ltd., Temuka; and
- "Radiation dosimetry," Auckland Hospital Board, Auckland.

The following are a few titles from the previous year:

- "Fume and waste gas measurements at New Zealand Steel Ltd., Glenbrook Plant;"
- "Transformer and insulation testing at the Central Waikato Electric Power Board;" and
- "Pollution control measurements at the Glenbrook Steel Mill."

[2] Some of the titles of master's theses in the last two years are:

- "Further experiments in inductively coupled RF plasma torches,"
- "Irradiation effects in some organic substances,"
- "Educational technology in physics teaching,"
- "Laser excitation of molecules,"
- "A PDP II IEEE interface,"
- "A low resolution VUV monochromator for UHV," and
- "Binary cross correlator."

[3] The titles of the doctor's theses completed in the last two years are:

- "Non-equilibrium transitions in quantum optical systems," and
- "Generation time statistics of *Escherichia coli*."

THE PHYSICS DEPARTMENT, UNIVERSITY OF HONG KONG

Leon H. Fisher

INTRODUCTION

There are two universities in Hong Kong and they are both publicly supported. They are the University of Hong Kong, founded in 1911, and the Chinese University of Hong Kong, founded in 1963. They both grant undergraduate degrees and master's degrees. Only the University of Hong Kong grants the Ph.D. Instruction is in English at the University of Hong Kong and in Chinese at the Chinese University of Hong Kong. The two universities are of comparable size, the University of Hong Kong having an enrollment of about 5400 and the Chinese University of Hong Kong about 4500. In addition, there exists the Hong Kong Polytechnic, founded in 1972, which is also publicly supported. At the present time, this institution grants no degrees, but soon will. Brief comments on the Chinese University of Hong Kong and the Royal Observatory in Hong Kong appeared in this *Bulletin 4* (1), 18 (1979).

THE UNIVERSITY OF HONG KONG

The University of Hong Kong is located in the city of Victoria on Hong Kong Island, overlooking Hong Kong harbor. The University has an excellent physical plant and the buildings and grounds are impressive. New engineering, science, and humanities buildings will be completed within the next three years.

The University faces an overwhelming demand for admission. About two qualified students are turned away for every one accepted. This is a ratio matched by only very few universities at the present time in the United States, and certainly by no large ones. However, it is my belief that the situation at the University of Hong Kong is much worse than the above rejection rate indicates because many qualified students probably do not even bother to apply, but seek their education abroad. This impression comes from knowing a large number of excellent students from Hong Kong obtaining their education in the United States. There is room for about 10,000 students in the two universities in Hong Kong, a community with a population of almost five million. The state of California, with a population of about 20 million, has approximately 400,000 students enrolled in public universities and colleges. The ratio of publicly-supported university students to population is about ten times as high in California as in Hong Kong. Nevertheless, the growth rate of the University of Hong Kong is being limited to 3% per annum. Such planning is made by the University and Polytechnic Grants Committee, a body which plans for all higher publicly-supported education in Hong Kong.

By descent, the population of Hong Kong is 99% Chinese. Of the students at the University of Hong Kong, 68.6% give their nationality as U.K. and 28.9% as Chinese. The remaining few percent are spread over about 30 nationalities. About 98% of the student body gives Hong Kong as its permanent residence.

In 1978-79, there were 643 students enrolled in science and 879 in engineering at the University of Hong Kong. There were 61 and 117 students enrolled in master's programs in science and engineering, respectively. Enrollments in Ph.D. programs in science and engineering were 19 and 16, respectively.

All support for research, other than private grants, comes from the university budget. There are no sources for research grants from the Hong Kong government or from the U.K. There is no NSF, ONR, ARO, AFOSR, DOE, or DOD to which grants or contracts may be applied for. About H. K. $1,000,000 (one American dollar equals about five Hong Kong dollars) is available to the entire university annually for small grants for the faculties of arts and sciences. This money is for equipment costing less than H. K. $100,000 per item and for research assistants. This fund is the only source for supporting research assistants. About a quarter of the million dollars goes to the faculty of science, and physics receives about a third of this amount. There is also another million Hong Kong dollars available annually for large equipment grants. Requests from this fund must be for items costing over H. K. $100,000.

THE PHYSICS DEPARTMENT FACULTY

The physics department at the University of Hong Kong has about eleven faculty members. There is one professor, two senior lecturers, and the rest are lecturers. A listing is now given of the faculty, with brief comments about their training, background, and work. A discussion of research activities of the department is given in the next section.

D. J. Newman is the Professor of Physics. He arrived 18 months ago and was formerly senior fellow of the Department of Solid State Physics in the Research School of Physical Sciences of the Australian National University, Canberra. His specialty is crystal field theory; he has a distinguished record in this field and plans to continue this work at Hong Kong. In his previous position, he was backed up by an extensive experimental spectroscopic program. It does not seem that such an experimental program will be undertaken at Hong Kong.

T. C. Boyce works in environmental physics. He has worked in the fields of thin films and x-rays.

H. Coxell works in cosmic rays. He came to the University of Hong Kong a few years ago from the University of the Witwatersrand, Johannesburg.

P. C. W. Fung is a theoretician. He received both his undergraduate and graduate training at the University of Tasmania in Hobart, Australia. After receiving his Ph.D. in 1966, he spent two years at Stanford University. Both his graduate work and his work at Stanford were in the field of plasma physics. He has also been interested in ionospheric physics. Fung has now branched out into the many-body problem and quantum theory. He came to the University of Hong Kong in 1970 and is one of the two senior lecturers in physics.

D. Healey works in the field of gemmology with emphasis on developing instruments of practical value to jewelers. Healey was trained as a theoretical physicist at Queens College, London University, with G. O. Jones. He then joined the Royal Radar Establishment. Before turning his attention to gemmology, Healey worked on lattice vibrations, Raman scattering from conduction electrons, and surface acoustic delay lines. He feels that it is difficult to stay in touch with physics in Hong Kong and also feels pressure to do something useful for the community. He has been at the University of Hong Kong for ten years.

P. K. MacKeown may be characterized as 75% theorist and 25% experimentalist. He received his Ph.D. from the University of Durham in 1966. His research is in the field of cosmic rays.

L. K. Ng received his bachelor's and master's degree at the University of Hong Kong, and the Ph.D. degree from the University of British Columbia in 1967. He is an experimental cosmic ray physicist. Ng had a year's study leave from the University, which he spent at the University of Durham. During that time, he worked on the interpretation of cosmic ray muon data in the light of results from the intersecting storage ring experiment, and on the relationship of the spectrum of sea level muons to that of the primary cosmic rays.

G. O. Walker received his training at the University of Leeds. He is an experimentalist specializing in ionospheric physics, geomagnetism, and electromagnetic theory. He is a senior lecturer.

E. C. M. Young received his undergraduate education at the University of Hong Kong and his Ph.D. at the University of Bristol in 1966. Like MacKeown, Young is 75% theorist and 25% experimentalist. He is working on cosmic rays, but is also interested in astrophysics and nuclear physics.

R. M. Yu, like Young, received his undergraduate education at the University of Hong Kong and his Ph.D. at the University of Bristol. Yu and Healey work together on gemmology. He also carries out experimental luminescence studies.

W. Y. Yu is a theoretical nuclear physicist. He has been at the University of Hong Kong for a year. He may be starting work with Newman on crystal field theory.

RESEARCH ACTIVITIES OF THE PHYSICS DEPARTMENT

CRYSTAL FIELD THEORY (Newman, possibly W. Y. Yu)

Newman came from a department whose major research interest is the spectroscopic study of paramagnetic centers in nonmetallic materials. Newman has published a large number of papers in crystal field theory in the last two years. The titles of some of the papers give an indication of the breadth and scope of his interests.

"Parameterization schemes in solid state physics,"
"Configuration interaction contributions to the correlation crystal field in Pr^{3+},"
- "Superposition model analysis of the near infrared spectrum of Fe^{2+} in pyrope-almandine garnets,"
"The orbit-lattice interaction for lanthanide ions. Determination of empirical parameters,"
- "Finite ligand size and Sternheimer antiscreening in lanthanide ions,"
- "Self-consistency correction to the Sternheimer parameter,"
"Calculation of the effect of spin-correlation on lanthanide crystal fields,"
- "Parametrization of crystal induced correlation between f-electrons,"
- "Isotropy of magnetic circular dichroism in cubic crystald,"
- "Prospects for *ab initio* calculations and models of superexchange interactions,"
"Ligand ordering parameters," and
- "On the g-shift of S-state ions."

In April of this year, Newman prepared an informal paper to inform faculty members and prospective graduate students his views on outstanding problems in this field, and on what problems he wants to work. The paper is entitled "Prospects for research on paramagnetic ions in crystals."

According to Newman, the general aim of theoretical research in crystal field theory is to develop a detailed understanding of the electronic structure of paramagnetic ions in solids in order to provide a theoretical basis for understanding energy transfer processes between different paramagnetic ions and between paramagnetic ions and the lattice modes of the host crystal. There are two methods of approach: one is the use of spectroscopic properties observed experimentally to provide modeling, and the other is to carry out *ab initio* calculations.

The detailed program proposed by Newman includes:

- "Phenomenological Parameter Fitting," which calls for re-analysis of data in order to obtain improved parameter fits. As a first step, a program has recently been developed for nf^2 systems in a cubic environment, aimed primarily at understanding certain actinide data. The main aim in carrying out this work will be to establish the relative importance of the three types of generalized crystal field that have been proposed: the relativistic, the correlation, and the spin-correlated crystal fields.

- "Applications of the Superposition Model" will be pursued. This method still has uncertainties related to local distortion effects, leaving doubts as to the underlying accuracy of the model. There is still room for development along the following lines:

  partition of the crystal field interaction into electrostatic and "contact" contributions,
  use of the superposition model description for other parameters such as S-state ion g factors,
  phase transition studies,
  use of the model to carry out parametrizations in case where insufficient data are available for a full phenomenological parametrization,
  description of transition intensity parameters, and
  relation of intrinsic parameters to other parameters describing crystal properties, e.g., ligand polarizability.

- "Dynamic Crystal Field" is an area of considerable physical interest because of the range of different phenomena that can be related to electron-phonon coupling (e.g., spin-lattice relaxation, Jahn-Teller effect, transition intensities). So little quantitative data are available that models, such as the superposition model, must be used to reduce the number of free parameters.

- "Local Distortion at Substituted Ions and the Relationship between Local and Bulk Strains" are crucial topics in the development of both model and *ab initio* techniques for understanding the spectra of paramagnetic ions in solids. At present, work is underway for the cubic NaCl and CaF_2 structure systems.

- "*Ab initio* Calculations" are needed in the following areas

  lanthanide outer shell screening of penetrating charges,
  spin polarization effects on both ligand and paramagnetic ion,
  ligand multipole polarization effects, and
  more accurate calculation of free ion parameters involving higher order perturbation calculations.

- "Superexchange" needs to be studied because the mechanism involved in the superexchange interaction between lanthanide ions in crystals are a long way from being understood.

GEMMOLOGY (Healey, R. M. Yu)

Hong Kong cuts all kinds of precious stones and is the second or third largest gem trading center in the world. This provides the motivation for the work in gemmology at the University of Hong Kong.

As an example of the needs of jewelers, one can discuss aquamarine. Naturally colored aquamarine gems are worth up to thousands of American dollars. However, it is possible to give aquamarine a deep blue color by irradiation. Such artificially irradiated gems are worth only a few dollars. The question arises how a jeweler can tell naturally colored from artificially colored aquamarine gems simply. The fact is that the color of natural aquamarine depends on the extraordinary rays for its color, whereas irradiated aquamarine depends on the ordinary rays for its color. This gives Healey and Yu the opportunity of developing instruments for the use of jewelers for distinguishing between naturally colored and irradiated aquamarine gems.

Healey and Yu publish (as coauthors) in the *Lapidary Journal* and in the *Journal of Gemmology*. Two of their recent papers are entitled:

"Practical color systems for gems," and
"The air-boundary refractometer."

In the first of these papers, the problem of classifying colors of gems is reviewed and discussed. The first method discussed involves visually matching the color of a gem with that of color chips or transparencies. The second method discussed involves quantitative measurements with instruments such as the spectrophotometer or tristimulus colorimeter.

In the second paper, a refractometer is described which utilizes the phenomenon of total internal reflection and which can measure higher indices of refraction than can be measured with the presently used refractometer. It can measure the refractive index of YAG (yttrium aluminum garnet) and cubic zirconia, and distinguish them from diamond. The instrument is very inexpensive and does not require an expensive prism. It does not require a refractive index liquid.

COSMIC RAYS (Coxell, MacKeown, Ng, Young)

Cosmic rays are being studied very extensively at the University of Hong Kong. MacKeown has a history of collaboration with Japanese scientists. Last year he was a coauthor of two papers entitled:

- "Electrons in large air showers observed at 5200 m above sea level," and
- "Muons in large air showers observed at 5200 m above sea level."

These experiments were carried out at Chacaltaya, Bolivia. The list of coauthors of these papers include workers from the Universidad Mayor de San Andres, La Paz, Bolivia; Tokyo Institute of Technology; Institute for Cosmic Ray Research, University of Tokyo; Department of Physics, Okayama University; the Institute of Physical and Chemical Research, Tokyo; Department of Physics, Kobe University; and Ehime University in Matsuyama, Japan.

Coxell, while at the University of the Witwatersrand, was a coauthor of a paper in 1978 with M. F. Crouch, F. Reines, and others, on a study of the intensity and angular distribution of cosmic-ray muons deep under ground, 3288 meters below the surface of the earth in a diamond mine in South Africa. The present work at Hong Kong is on the time variation of the intensity of cosmic rays. There is a large project in which detection instruments have been placed in the Aberdeen tunnel (Aberdeen is a city on the coast of Hong Kong Island, about forty minutes by car from Victoria).

IONOSPHERIC PHYSICS (Walker)

In publications in recent years, Walker has written on the diurnal variation of the equatorial anomaly in the topside ionosphere at sunspot maximum and on the early morning development and the evening decay of electron content-latitude profiles at low latitudes and their dependence on solar declination. The equatorial anomaly was studied by analyzing ionograms taken by the topside sounding satellites Alouette II and ISISA, recorded in Singapore. The electron content-latitude profiles were obtained from Faraday rotation records of the 40 MHz signal from the Intelsat satellite taken by stations at Hong Kong and Bali. In another publication just a few years ago, Walker discussed the topside variations of ion mass across the magnetic equator during the northern winter solstice, based on a plasma temperature model applicable to sunspot maximum conditions. In his most recent publication, one that appeared in 1979, Walker discussed the correlation of the peak storm surges at a particular location in Hong Kong due to tropical storms with differing storm tracks and landfall positions relative to Hong Kong. He obtained empirical equations relating the peak surge with the central pressure of the storm and the local maximum wind speed. For storms making landfall near Hong Kong, the associated storm surges are most severe. At a fixed location, peak surges, which are expected to occur around the time of landfall, depend most significantly on the central pressure of the storms. An empirical relationship between these two parameters was obtained and this could be used for forecasting the peak surge, provided that a reasonable estimate of the central pressure of a particular storm is available.

Thus, Walker is active in ionospheric physics and weather forecasting, among other things. The seminar given at the University when I was there had been on the equatorial anomaly.

PLASMA PHYSICS (Fung)

Last year, Fung published two papers on plasma physics. One was on a comparison of spin-flip and normal synchrotron radiation from a charge rotating in a magnetized plasma and the other was on an equation of polarization transfer in an inhomogeneous magnetized plasma. He also published a paper a year or so ago on the expression for the electric energy density in a dissipative medium.

G-M COUNTERS (Tan)

L. C. Tan recently arrived at the University of Hong Kong, having come from the Institute of High Energy Physics of the Academica Sinica in Beijing. At the Academica Sinica, he carried out some work on Geiger-Mueller counters under the aegis of Professor T. Ho. This work is an experimental study of the operation of argon-pentane-filled counters where an r.f. voltage is superimposed on the usual d.c. voltage across the electrodes. A theoretical analysis of the Geiger threshold voltage under these conditions has been worked out. It is hoped that the characteristics of a counter with an additional rf voltage may find some practical applications such as providing an output pulse amplitude spectrum unobservable under dc voltages. This spectrum may depend on the direction of the ionizing particle. Tan has pointed out in a publication in Chinese [Physica *3*, 352 (1974)] that, if it is desired to develop a sensitive measurement of x-ray polarization on the basis of the photoelectric effect in a low-pressure counter filled with heavy gases, it is important to try to determine the direction of emission of photo-electrons. The new work is being prepared for publication.

SOME OTHER FACTS ABOUT THE PHYSICS DEPARTMENT

About 25 students a year receive their bachelor's degree in physics from the University of Hong Kong. Last year, four of those students went to the United States for graduate study, two of them to the University of California at Berkeley. The best undergraduate students, on completing their work, often go to the U.S. or U.K. for graduate work. Undergraduates in physics who do not go on for graduate work go into teaching, computing, or other activities such as banking. They are not employed as physicists. Graduate students in physics at the University of Hong Kong must first work for their M. Phil. Many such students are graduates of the Chinese University of Hong Kong or are school teachers. Once they obtain this degree, they may proceed to the Ph.D. program. About one or two Ph.D.'s a year are granted in physics.

An external examiner comes every three years to inspect the physics program and to go over the examination papers. Professor W. F. Nash of the University of Nottingham is the external examiner for the 1977-1980 period.

There are three graduate students working with Fung, three with Newman, and one with R. M. Yu.

The physics department of the University of Hong Kong is active in the physical Society of Hong Kong. The membership of the Physical Society is about 15 and meets once a month.

INTERNATIONAL MEETINGS IN THE FAR EAST

1980–1983

compiled by Seikoh Sakiyama

It is intended to update and augment this list in future issues of the Scientific Bulletin. The assistance of Dr. T. D. Grace, Australian Embassy, Tokyo, and Dr. M. J. McNamara, New Zealand Embassy, Tokyo, in supplying a listing of meetings in their countries is deeply appreciated. Similarly, the assistance of Dr. Robert Stella, American Embassy, New Delhi (formerly in Seoul), in supplying a listing of meetings in Korea is deeply appreciated. Readers are asked to notify us of upcoming international meetings in the Far East which have not yet been included in this list.

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Date	Title	Site	For information, contact
September 28-October 2	Symposium 1980 I.A.H.R. (International Association for Hydraulic Research), Section for Hydraulic Machinery Equipment and Cavitation	Tokyo, Japan	Prof. Dr. Masaaki Shirakura, Faculty of Engineering, University of Tokyo 7-3-1, Hongo, Bunkyo-ku, Tokyo 113
September 29-October 3	The 3rd International Conference on Ferrites	Kyoto, Japan	Prof. M. Sugimoto, Dept. of Electronics, Faculty of Engineering, Saitama University *255, Shimo-Ohkubo, Urawa* Saitama 338
September 29-October 4	International Conference on Steel Rolling (The Science and Technology of Flatt-rolled Products)	Tokyo, Japan	The Iron and Steel Institute of Japan Keidanren Kaikan, 1-9-4, Ohtemachi, Chioyoda-ku, Tokyo 100
September 29-October 4	The 3rd World Conference on Medical Information	Tokyo, Japan	Prof. Masamitsu Oshima MEDINFO 80 Tokyo P.O. Box 40, Hongo, Tokyo 113
September 30-October 4	The 8th International Conference on Computative Linguistics (COLING 80)	Tokyo, Japan	Prof. Makoto Nagao, Dept. of Electronics Engineering, Faculty of Engineering, Kyoto University Yoshida-Honcho, Sakyo-ku, Kyoto 606
October 1-3	The 10th International Symposium on Fault-Tolerant Computing	Kyoto, Japan	G. S. Mr. Shoji Watanabe Kokusai Denshin Denwa Co., Ltd. 2-3-2, Nishi-Shinjuku, Shinjuku-ku, Tokyo 160
October 2-5	3rd Asian Seminar for Radiologic Technologists	Nagoya, Japan	Organizing Council, Dept. of Radiation Therapy, Aichi Cancer Center Hospital 81-1159 Tashiro-cho, Chikusa-ku, Nagoya-shi, Aichi 464

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Date	Title	Site	For information, contact
October 4-6	ICAMHTS (International Conference on Automated Multiphasic Health Testing & Services) Tokyo	Tokyo, Japan	PL Medical Center P.O. Box 1 Tondabayashi-Kyoku, Osaka 584
October 6-9	The 8th World Computer Congress I.F.I.P (The International Federation for Information Processing) Congress '80	Tokyo, Japan	Information Processing Society of Japan, Kikai Shinko Kaikan 3-5-8, Shiba-Koen, Minato-ku Tokyo 105
October 6-10	Thirteenth Symposium on Naval Hydrodynamics	Tokyo, Japan	Prof. Takao Inui, Dept. of Naval Architecture, Faculty of Engineering, University of Tokyo, 7-3-1, Hongo, Bunkyo-ku, Tokyo 113
October 8-14	The 12th CODATA General Assembly and the 7th International CODATA Conference	Kyoto, Japan	Prof. T. Shimanouchi, College of Science, Tsukuba University, Saiki, Sakura-mura, Niihari-gun Ibaraki 300-31
October 12-17	10th World Congress on Metal Finishing (INTERFINISH '80)	Kyoto, Japan	The Metal Finishing Society of Japan Kyodo Bldg. 2, Kanda-Iwamoto-cho Chiyoda-ku, Tokyo 101
October 13-15	1980 International Electrical Research Exchange (IERE) Annual Meeting	Tokyo, Japan	The Japan IERE Council, Central Research Institute of Electric Power Industry, Ohtemachi Bldg. 1-6-1, Ohtemachi, Chiyoda-ku, Tokyo 100
October 13-17	The 6th International Symposium on the Transport of Dangerous Goods by Sea and Inland Waterways	Tokyo, Japan	Japan Marine Surveyors and Sworn Measurer's Association, Kaiji Bldg., 1-9-7, Hatchobori, Chuo-ku Tokyo 104
October 13-17	Electric Energy Conference	Sydney, Australia	The Institution of Engineers, Australia, 11 National Circuit, Barton, ACT, 2600
October 13-17	The XIth International Pigment Cell Conference	Sendai, Japan	Prof. M. Seiji, Dept. of Dermatology, School of Medicine, Tohoku University 1-1 Seiryo-cho, Sendai-shi Miyagi 980
October 14-17	8th World Computer Congress (International Federation for Information Processing)	Melbourne, Vic. Australia	8th World Computer Congress, P.O. Box 880G, Melbourne, Vic. 3001 (Mr. A. W. Goldsworthy, State Govt. Insurance Office (Qld), Box 1453 G.P.O. Brisbane, QLD. 4001)
October 15-17	The Fifth International Conference on Computers in Chemical Research and Education (ICCCRE)	Toyohashi, Japan	Prof. Shin-ichi Sasaki, School of Materials Science, Toyohashi University of Technology, Tempaku, Toyohashi, Aichi 440

1980—Continued

Date	Title	Site	For information, contact
October 20-24	Multinational Workshop on Energy Conservation and Alternative Energy	Chung-nam, Korea	Dr. Woong-Ki Kang, President, Korea Energy Research Institute 45 Mugyodong, Chung-ku Seoul 100
October 20-25	16th Meeting of the Scientific Committee for Antarctic Research (SCAR)	Queenstown, New Zealand	Royal Society of New Zealand, Box 12249, Wellington
October 26-31	The 3rd International Meeting on Radiation Processing	Tokyo, Japan	Research Corporation Section, Administration Division, Takasaki Radiation Chemistry Research Establishment, Japan Atomic Energy Research Institute 1233 Watanukicho, Takasaki-shi, Gumma 370-12
October 27-29	International Conference on Welding Research in the 1980's	Osaka, Japan	International Conference Committee Welding Research Institute, Osaka Univ. Yamada-Kami, Suita, Osaka 565
October 27-November 1	Second International Symposium on Manganese Dixoide	Tokyo, Japan	Second MnO_2 Symposium Committee The Electrochemical Society of Japan 1-12-1 Yuraku-cho, Chiyoda-ku Tokyo 100
October (tentative)	RACI Cereal Chemistry Div 30th Annual Conference	Melbourne, Australia	Dr. R. A. Orth, Aust. Wheat Board G.P.O. Box 4562 Melbourne, Vic. 3001
October (tentative)	Fifth International Conference of Endocrinology	Sydney, Australia	Prof. Brian Hudson, University of Melbourne, Parkville, Vic. 3052
November 2-9	73rd International Conference Federation Aeronautique	Auckland, New Zealand	RNZAC, Trillos
November 3-7	Second Asia and Oceania Congress of Nuclear Medicine	Manila, Philippines	Dr. Flora M. Pascasio, Second AOCNM P.O. Box EA53, Ermita, Manila
November 4-6	Hydrology and Water Resources Symposium	Adelaide, Australia	The Institution of Engineers, Australia, 11 National Circuit, Barton, ACT 2600
November 4-8	Fourth Joint Meeting MMIJ-AIME (MMIJ: The Mining and Metallurgical Institute of Japan. AIME: American Institute of Mining, Metallurgical, and Petroleum Engineers.)	Tokyo, Japan	S. G. Satoru Suda, MMIJ 5-4, Ginza 8-chome Chuo-ku, Tokyo 104
November 10-14	Magneto Hydrodynamic Congress	Adelaide, Australia	The Institution of Engineers, Australia, 11 National Circuit, Barton, ACT 2600
November 10-21	Xth International Conference on Lighthouses and Other Aids to Navigation	Tokyo, Japan	Navigation Aid Dept., Maritime Safety Agency, 2-1-3, Kasumigaseki, Chiyoda-ku, Tokyo 100

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Date	Title	Site	For information, contact
November 11	The First World Congress of International Society of Esophageal Diseases	Tokyo, Japan	Dr. K. Nakayama, Director, Nakayama Cancer Institute, 6-7-19, Ginza, Chuo-ku, Tokyo 104
November 18-20	Microprocessors Conference	Sydney, Australia	The Institution of Engineers, Australia, 11 National Circuit, Barton, ACT, 2600
November 24-28	1st International Conference on Technology for Development	Canberra, Australia	The Institution of Engineers, Australia, 11 National Circuit, Barton, ACT 2600
November 26-27	The 5th International Ocean Symposium	Tokyo, Japan	Japan Ocean Association, 1-4-4 Kasumigaseki, Chiyoda-ku, Tokyo 100
November (tentative)	Geothermal Seminar	Rotorua, New Zealand	NZ Foreign Affairs Ext. Aid Div. Wellington
December 1-5	4th International Symposium on Nitrogen Fixation	Canberra, Australia	Dr. A. H. Gibson, CSIRO Div. of Plant Industry, Box 1600 Canberra, ACT 2601
December 4-5	Lubrication Conference	Melbourne, Australia	The Institution of Engineers, Australia, 11 National Circuit, Barton, ACT, 2600
January 25-31	International Symposium on Erosion and Sediment Transport in Pacific Rim Steeplands	Canterbury, New Zealand	Royal Society of New Zealand Box 12249, Wellington
January 31-February 4	Conference on Large Earthquakes	Napier, New Zealand	Royal Society of New Zealand Box 12249, Wellington
February 11-18	International Conference on Soils with Variable Charge	Massey, New Zealand	Royal Society of New Zealand Box 12249, Wellington
February (tentative)	Fifth International Conference on Ion Beam Analysis	Sydney, Australia	Professor J. C. Kelly Department of Physics, University of NSW, PO Box 1 Kensington, NSW, 2033
March 5-10	1st International Seminar on Semiconductor Processing	Gumi, Korea	Mr. K. B. Whang, Director, Korean Institute of Electronics Technology
March 13-14	The 2nd International Symposium on Hemophilia Treatment	Tokyo, Japan	Prof. T. Abe, Teikyo University School of Medicine, 2-11-1, Kaga, Itabashi, ku, Tokyo 173
March 20-21	The Second International Symposium on Bone, Structure, Function & Disease	Adelaide, Australia	Dr. M. J. Hooper, Royal Adelaide Hosp. North Terrace, Adelaide, SA, 5000
March (tentative)	Ecotoxicological Problems in the Indo-Pacific Region	Taipei, Taiwan	Dr. Jong-Chin Su, Institute of Zoology Academia Sinica, Taipei 115

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Date	Title	Site	For information, contact
April 13-17	International Telecommunications Conference	(Undecided) New Zealand	NZ Post Office Wellington
April 26-May 1	1st Asian and Pacific Chemistry Congress	Singapore, Republic of Singapore	The Congress Secretary, 1st Aspac Congress, Singapore Professional Center 129B Block 23 Ontram Park Singapore 0316 Republic of Singapore
May 11-15	4th International Conference on Trace Metabolism in Man & Animals (TEMA)	Perth, Australia	Australian Academy of Science PO Box 783, Canberra City, ACT, 2601
May 11-15	Australian Biochemical Society Annual Meeting	Adelaide, Australia	Dr. H.C. Robinson, Dept. Biochemistry, Monash University, Clayton, Vic., 3168
May 18-22	Fourth International Coral Reef Symposium	Manila, Philippines	Marine Sciences Center, IV CRS University of the Philippines, PO Box 1 Diliman, Quezon City 3004
May 23-30	The 12th Conference of the International Association of Ports and Harbors	Nagoya, Japan	Nagoya Port Authority 1-8-21, Irifune, Minato-ku Nagoya 455
May (tentative)	34th Annual Metals Congress	Sydney, Australia	undecided
May (tentative)	Electric Energy Manufacturing Conference	(undecided) Australia	The Institution of Engineers, Australia, 11 National Circuit, Barton, ACT, 2600
June 6-7	The 4th International Symposium on Quality Control–Osaka	Kobe, Japan	Secretariat, ISQC-Osaka, Kobe Minato P.O. Box 569, Hyogo 651-01
June 29-July 3	The VIIth International Symposium on Gnotobiology	Tokyo, Japan	Prof. S. Sasaki, Chairman, Organizing Committee, VII International Symposium on Gnotobiology, Dept. of Microbiology, School of Medicine, Tokai University, Bohseidai, Isehara-shi, Kanagawa 259-11
June (tentative)	ROK-ROC Seminar on Oceanography	Seoul, Korea	Korea Ocean Research and Development Institute, P.O. Box 17, Yang-Jae Seoul
July 19-24	8th International Congress of Pharmacology–IUPHAR–	Tokyo, Japan	The Japanese Pharmacological Society Gatsukai Center Bldg. 4F, 2-4-16, Yayoi Bunkyo-ku, Tokyo 113
July 27-August 1	The 4th International Congress of Biorheology	Tokyo, Japan	Japanese Society of Biorheology, Physics Laboratory, Keio University 4-1-1, Hiyoshi, Kohoku-ku Yokohama 223

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Date	Title	Site	For information, contact
August 10-14	International Congress of Pharmacology	Sydney, Australia	Australian Academy of Science P.O. Box 783 Canberra City, A.C.T. 2601
August 21-28	XIII International Botanical Congress	Sydney, N.S.W. Australia	Executive Secretary, Dr. W. J. Cram School of Biological Sciences, Univ. of Sydney, N.S.W., 2006
August 24-26	Vth International Conference on Electrical Bio-impedance	Tokyo, Japan	Prof. K. Nakayama, Dept. of Electrical & Electronic Engineering. Sophia Univ. 7 Kioicho, Chiyoda-ku Tokyo 102
August 24-28	4th International Conference on Rapidly Quenched Metals	Sendai, Japan	The Japan Institute of Metals Aramaki Aoba Sendai, Miyagi 980
August 24-28	International Federation of Automatic Control (IFAC) 8th Triennial World Congress	Kyoto, Japan	Prof. Y. Sawaragi, Dept. of Applied Mathematics and Physics, Faculty of Engineering, Kyoto University Yoshida-Honmachi, Sakyo-ku Kyoto 606
August (tentative)	17th Annual Congress of the Australian and New Zealand College of Psychiatrists	Victoria, Australia	(Undecided)
September 1-5	9th ICAS-XXII CSI (9th International Conference on Atomic Spectroscopy and XXII Colloquium Spectroscopium Internationale)	Tokyo, Japan	The Japan Society for Analytical Chemistry, 9th ICAS-XXII CSI Gotanda-Sanhaitsu, 26-2, 1-chome, Nishi-gotanda, Shinagawa-ku, Tokyo 141
September 12-18	The 10th International Congress of Electroencephalography and Clinical Neurophysiology	Kyoto, Japan (undecided)	International Conference Organizers, Inc. Crescent Plaza 103, 2-4-6, Minami-Aoyama, Minato-ku, Tokyo 107
September 17-21	The 14th World Congress of International League against Epilepsy and the 13th Symposium of the International Bureau for Epilepsy	Kyoto, Japan	International Conference Organizers, Inc., Crescent Plaza 103, 2-4-6, Minami-Aoyama, Minato-ku, Tokyo 107
September 20-23	1981 International Symposium on Gallium Arsenide and Related Compounds	Kanagawa, Japan	Prof. H. Yanai, Dept. of Electronic Engineering, University of Tokyo 7-3-1, Hongo, Bunkyo-ku, Tokyo 113
September 20-25	12th World Congress of Neurology	Kyoto, Japan	Simul International, Inc., No. 9, Kowa Bldg., 1-8-10, Akasaka, Minato-ku, Tokyo 107
September 23-25	Australasian Society of Nephrology joint meeting with Cardiac Society	Brisbane, Australia	Dr. B. M. Saker, Renal Unit, Royal Perth Hospital, Perth, WA, 6000

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Date	Title	Site	For information, contact
September (tentative)	International Rock Mechanics Symposium on Weak Rock - Soft, Fractured and Weathered Rock–	Tokyo, Japan	Japan Society of Civil Engineers 1-chome, Yotsuya, Shinjuku-ku Tokyo 160
October 4-7	4th Congress of International Society for Laser Surgery	Tokyo, Japan	Narong Nimsakul, M.D Secretary General 4th Congress of International Society for Laser Surgery, Dept. of Plastic Surgery, School of Medicine Tokai University, Boseidai, Ischara-shi Kanagawa Pref. 259-11
October 7-9	Symposium on Industrial Robots and Robot Exhibit	Tokyo, Japan	Mr. Y. Komori, Japan Industrial Robot Association, Kikai Shinko Bldg., 3-5-8 Shiba-Koen, Minato-ku, Tokyo 105
October 11-23	International Union Conservation of Nature and Natural Resources	Christchurch, New Zealand	Lincoln College, Christchurch
October 18-25	15th Annual Conference on Law of the Sea	Seoul, Korea	Korea Ocean Research and Development Institute, P.O. Box 17 Yang-Jae, Seoul
Late October-Early November	FAI the 74th General Conference, 1981 (International Aeronautical Federation)	Tokyo, Japan	Japan Aeronautic Association, 1-18-2 Shinbashi, Minato-ku, Tokyo 107
December (tentative)	Ninth International Symposium on Comparative Endocrinology	Hong Kong	Prof. B. Lofts, Department of Zoology The University of Hong Kong
	1982		
April/May (tentative)	Second International Workshop on the Malacofauna of Hong Kong and south China	Hong Kong	Dr. B. S. Morton, Dept. of Zoology The University of Hong Kong
May 10-15	General Meeting of the International Association of Geodesy	Tokyo, Japan	Assist. Prof. I. Nakagawa, Geophysical Institute, Faculty of Science, Kyoto University, Oiwake-cho, Kita-Shirakawa Sakyo-ku, Kyoto 606
May 23-28	16th International Congress of Dermatology (CID)	Tokyo, Japan	Japan Convention Services, Inc., Nippon Press Center 8F, 2-2-1, Uchisaiwai-cho Chiyoda-ku, Tokyo 100
June 7-11	9th International Congress on Electrocardiology (23rd International Symposium on Vector-cardiography)	Tokyo, Japan	Tokyo University School of Medicine 7-3-1 Hongo, Bunkyo-ku, Tokyo 113
June 7-11	Fourth International Symposium on the Genetics of Industrial Microorganisms	Kyoto, Japan	GIM Japan National Committee, Microbiology Research Foundation 2-4-16 Yayoi, Bunkyo-ku, Tokyo 113

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Date	Title	Site	For information, contact
June (tentative)	Twelfth International Conference of Biochemistry	Sydney, Australia	Prof. W. H. Elliot, Biochemistry Dept. University of Adelaide Adelaide, S.A. 5000
July 5-10	VI International Symposium on Solute–Solute–Solvent Interactions	Osaka, Japan	Prof. H. Ohtaki, Tokyo Institute of Technology at Nagatsuta, Dept. of Electronic Chemistry, Nagatsuta, Midori-ku, Yokohama 227
Mid-July (tentative)	The 5th International Congress of Plant Tissue	Yamanashi, Japan	Assistant Prof. A. Komamine Dept. of Botany, Faculty of Science University of Tokyo 7-3-1, Hongo, Bynkyo-ku Tokyo 113
August 9-September 3	The 5th International Congress of Pesticide Chemistry, IUPAC	Kyoto, Japan	Rikagaku Kenkyusho 2-1, Hirosawa, Wako, Saitama 351
August 15-21	International Biochemical Congress	Perth, Australia	Australian Academy of Science and International Union of Biochemistry P.O. Box 783, Canberra ACT 2601
August 22-27	Fourth International Conference on Organic Synthesis (IUPAC)	Tokyo, Japan	Prof. T. Mukaiyama, Dept. of Chemistry Faculty of Science, University of Tokyo 7-3-1, Hongo, Bunkyo-ku, Tokyo 113
August (tentative)	The Royal Australian Chemical Institute 7th National Convention	Canberra, Australia	Executive Secretary, RACI HQ 191 Royal Parade, Parkville, Vic. 3052
August (tentative)	13th Australian Spectroscopy Conference	(undecided) Australia	Australian Academy of Science P.O. Box 783, Canberra City, ACT 2601
August (tentative)	1982 International Conference on Solid State Devices	Tokyo, Japan	The Japan Society of Applied Physics Kikai-Shinko-Kaikan, 5-8, 3-chome, Shibakoen, Minato-ku, Tokyo 105
August (tentative)	International Biochemistry Congress	Perth, W.A. Australia	Australian Academy of Science. P.O. Box 783, Canberra City, ACT 2601
Late August (tentative)	the 8th Triennial Congress of the International Ergonomics Association	Tokyo, Japan	Prof. M. Oshima, Medical Information Systems, Development Center, Akasaka Park Bldg., 2-3-4, Akasaka, Minato-ku Tokyo 107
September 5-10	International Conference on Magnetism–1982 (ICM-1982)	Kyoto, Japan	Prof. J. Kanamori, Faculty of Science Osaka Univ., Toyonaka, Osaka Pref. 560
September 6-10	International Conference on Nuclear Physics in the Cyclotron Energy Region	Osaka, Japan	Prof. M. Kondo, Research Center for Nuclear Physics, Osaka University Yamada-kami, Suita-shi Osaka Pref. 565

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Date	Title	Site	For information, contact
September (tentative)	6th International Symposium on on Contamination Control	Tokyo, Japan	Japan Air Cleaning Association 6-7-5, Soto-Kanda, Chiyoda-ku Tokyo 101
October 4-6	Third International Dental Congress on Modern Pain Control	Tokyo, Japan	Japan Convention Service, Inc. Nippon Press Center 8F, 2-2-1 Uchisaiwai-cho, Chiyoda-ku Tokyo 100
November 17-19	3rd JIM (Japan Institute of Metals) International Symposium	(Undecided) Japan	The Japan Institute of Metals Aza Aoba, Aramaki, Sendai-shi Miyagi 980
Undecided	International Conference on Mass Spectroscopy	Hawaii, U.S.A.	Prof. T. Tsuchiya, Basic Science Lecture Room, Chiba Institute of Technology 1-17-2, Tsudanuma, Narashino *Chiba 275*
Undecided	International Rehabilitation Medicine Association Fourth World Congress	Sydney, Australia	Prof. G. G. Burniston, Dept. of Rehabilitation Medicine, Prince Henry Hospital Little Bay, N.S.W. 2036
Undecided	Workshop on Marine Microbiology	Seoul, Korea	Korea Ocean Research and Development Institute, P.O. Box 17,Yang-Jae Seoul

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May 10-12	Royal Australian College of Physicians ASM	Sydney, Australia	RACP, 145 Macquarie Street, Sydney NSW, 2000
May (tentative)	52nd ANZAAS Conference	Perth, Australia	Dr. G. Chandler, Univ. of Western Australia, Nedlands, W.A. 6009
August 1-7	International Association for Dental Research	Sydney, Australia	Mr. Scott Gotjamanos, Department of Pathology, Perth Medical Centre Verdon Street, Nedlands, W.A. 6009
August 17-24	Fourth International Congress of Plant Pathology	Melbourne, Australia	Mr. B. Price, Victorian Plant Research Institute, Dept. of Agriculture, Victoria Swan Street, Burnley, Vic. 3121
August 27-31	Twenty-fifth International Geographical Congress	Sydney, Australia	Australian Academy of Science P.O. Box 783 Canberra City, A.C.T. 2601
August 28-September 2	29th International Congress of Physiology	Sydney, Australia	Australian Academy of Science PO Box 783, Canberra City, ACT 2601
August 28-September 3	The 3rd International Mycological Congress (IMC 3)	Tokyo, Japan	Prof. K. Tsubaki, Institute of Biological Sciences, The University of Tsukuba Sakura-mura, Ibaraki Pref. 305

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Date	Title	Site	For information, contact
August 29-September 2	International Union of Physiological Sciences Congress	Sydney, Australia	Australian Academy of Science P.O. Box 783 Canberra City, A.C.T. 2601
August (tentative)	International Solar Energy Congress	Perth, Australia	Mr. P. Driver, Honorary Secretary P.O. Box 123, Nedlands, W.A. 6009
October (tentative)	8th International Conference on Calcium Regulating Hormone	(Kobe), (tentative) Japan	Prof. T. Fujita, 3rd Division, Dept. of Medicine, School of Medicine, Kobe University, 7-13, Kusonoki-cho, Ikuta-ku, Kobe 650
October 29-November 3	71st FDI Annual World Dental Congress (Federation Dentaire Internationale)	Tokyo, Japan	Japan Dental Association (Japanese Association for Dental Science), 4-1-20, Kudan-kita, Chiyoda-ku, Tokyo 102
Undecided	Thirteenth International Congress of Chemotherapy	Melbourne, Australia	Dr. B. Stratford, St. Vincent's Hospital 59 Victoria Parade, Fitzroy, Vic. 3065

THE EIGHTH INTERNATIONAL LIQUID CRYSTAL CONFERENCE

Rudolph J. Marcus

The Eighth International Liquid Crystal Conference was held 30 June-4 July, 1980, in Kyoto, Japan. Although no one from ONR/Tokyo was at this meeting, the abstracts of papers given at this meeting are available at this office and specific ones can be sent to those who request them.

There were 12 main sessions devoted to the following subjects at the meeting:

- Mesomorphic states and phase transitions
- Molecular structure and dynamics
- Mechanical (rheological) properties and defects
- Electrical, optical, and other properties of liquid crystals
- Synthesis and properties of new LC materials
- Polymer mesophases
- Mesophases of disk-like molecules and carbonaceous materials
- LC states of amphiphiles; LC's in biological systems
- Displays and other applications
- Interface and anchoring
- New application-related materials
- Reliability, standards, and human factors

In an opening address, G. W. Gray of the University of Hull listed three areas of research which had seen considerable development since the previous international conference in 1979:

- New liquid crystal materials containing non-aromatic ring systems and the developments which have followed from the earlier studies of esters of trans-4-n-alkylcyclohexane-1-carboxylic acids and the trans-4-n-alkyl-1-(4'-cyanophenyl) cyclohexanes (PCH's).
- Agreement over a nomenclature problem concerning smectic polymorphs and some interesting features of the smectic phase sequences for the 4-n-alkoxy-benzylidene-4'-n-alkylanilines.
- Discotic phases–the discovery that the historically well-known mesophase of di-isobutylsilandiol is a discotic liquid crystal phase and the progress being made in studies of other discotic systems.

- J. D. Litster
  Department of Physics and Center for Materials Science and Engineering
  Massachusetts Institute of Technology
  Cambridge, MA 02139
  U.S.A.

  Experimental studies of liquid crystal phase transitions

- Lin Lei
  Institute of Physics
  Academia Sinica, Beijing
  People's Republic of China

  Statistical mechanics of liquid crystals–beyond MFA

- Chia-Wei Woo
  Department of Physics
  University of California, San Diego
  La Jolla CA 92093
  U.S.A.

  The search for quantum liquid crystals

- D. L. Johnson
  Department of Physics and Liquid Crystal Institute
  Kent State University
  Kent, OH 44242
  U.S.A.

  Thermodynamics of the nematic–smectic A–smectic C multicritical point

- P. Martinoty
  Laboratoire d'Acoustique Moleculaire
  Universite Louis Pasteur
  4, rue Blaise Pascal
  67070 Strasbourg Cedex
  France

  On the shift of the ultrasonic attenuation peak at the phase transitions in liquid crystals

- J. Prost
  Centre de Recherches Paul Pascal
  Domaine Universitaire
  33405, Talence
  France

  Commensurability problems in the smectic phases

- H. J. Coles
  Department of Physics
  Schuster Laboratory
  University of Manchester
  Manchester, M13 9PL
  U.K.

  The order-disorder phase transition in liquid crystals as a function of molecular structure: influence of the smectic a phase on the characteristics of the isotropic-mesomorphic phase transition.

- A. J. Leadbetter
  Chemistry Department
  University of Exeter
  Exeter, EX 4 4QD
  U.K.

  Novel liquid crystal structures and phase transitions

- N. Murayama
  Department of Materials Science
  The University of Electro-Communication
  5-1, Chofugaoka 1-chome
  Chofu, Tokyo 182
  Japan

  Critical properties of chiral smectic A-C phase transition

- F. Hardouin
  C.R.P.P.
  Universite de Bordeaux I
  33405 Talence
  France

  Unusual nematic and smectic phases in long "rod-like" derivatives with terminal polar groups

- K. Miyano
  Northwestern University
  Evanston, IL 60201
  U.S.A.

  Mechanical properties of thin films of a liquid crystal

- Z. Luz
  Department of Isotope Research
  Weizmann Institute of Science
  Rehovot
  Israel

  Molecular ordering in blue and cholesteric phases of cholesteryl-alkanoates–a deuterium nmr study

– F. Rustichelli
Dipartimento di Scienze Fisiche
Facolta di Ingegneria
Universita di Ancona
Italy

Investigation by x-ray diffraction of the several phases of OPCTS

– Adriaan de Vries
Liquid Crystal Institute and Department of Physics
Kent State University
Kent, OH 44242
U.S.A.

Smectic liquid crystal phases

– I.G. Chistyakov
Institute of Crystallography Academy of Sciences of USSR
Leninsky prospekt 59
Moscow 117333
USSR

The structure of thermotropic liquid crystals

– Y. R. Shen
Department of Physics, University of California
Berkeley, CA 94720
U.S.A.

Measurement of orientational statistics of a liquid crystal by optical absorption and photo-luminescence

– M. R. Fisch
Harvard University
Cambridge, MA 02138
U.S.A.

Light scattering from free surface smectic a liquid crystals

– J. R. Lalanne
University of Bordea 'x I and CNRS Paul Pascal
University Domain 33405
Talence
France

The even-odd effect in liquid crystals: a collective or intrinsic molecular property?

– J. W. Doane
Department of Physics and Liquid Crystal Institute
Kent State University
Kent, OH 44242
U.S.A.

Asymmetry in chain ordering

– F. Volina
Centre d'Etudes Nucleaires de Grenoble
Department de Recherche
Fondamentale
Section de Physique du Solide
85X, 38041 Grenoble Cedex
France

Chain ordering in the mesophases of TBBA

– S. Ochiai
Department of Chemistry
Faculty of Science, Science University of Tokyo
3, Kagurazaka 1-chome, Shinjuku-ku
Tokyo 162
Japan

^{13}C relaxation times study of liquid crystalline p-methoxybenzylidene-p-n-butylaniline

– F. M. Leslie Department of Mathematics University of Strathclyde Glassgow, Scotland Gl 1XH	Viscometry of nematic liquid crystals
– M. Kleman Universite Paris-Sud Physique des Solides Bat. 510, 91405 Orsay France	Domains and defects in mesophases of disc-like molecules
– S. Hirata Research Laboratory of Precision Machinery and Electronics Tokyo Institute of Technology 4259, Nagatsuda-cho, Modori-ku Yokohama, Kanagawa 227 Japan	New molecular alignment models of bubble domains and striped domains in cholesteric-nematic mixtures
– M. G. Clark Royal Signals and Radar Establishment Malvern, Worcs WR14 3PS U.K.	A study of flow alignment instability during linear oscillatory shear of nematics
– A. Pouprere Centre de Recherche Paul Pascal Domaine Universitaire 33405 Talence France	Viscoelastic behavior in normal and reentrant smectic A–systems
– Tsutomu Honda Fusion Technology Development Office Toshiba Corporation 3-13-12, Mita Minato-ku, Tokyo 108 Japan	Electroviscous effect in liquid crystals and in isotropic liquids
– A. F. Martins Centro de Fisica de Materia Condensada (INIC) 2, Av. Gama Pinto 1699 Lisboa Codex Portugal	Generalization of the simple molecular statistical theory of the nematic viscosity γ_1 (T)
– F. Schneider Physikalische Chemie Universitat Siegen 5900 Siegen 21 Federal Republic of Germany	Determination of the viscosity coefficients of some nematic crystals
– Paul Manneville Dph-G/PSRM Orme des Merisiers CEN Saclay 91190 Gif Sur Yvette France	The transition to turbulence in nematic liquid crystals

– S. A. Pikin
Institute of Crystallography
The Academy of Sciences of the USSR
Moscow 117333
USSR

Modulated structures in dielectric liquid crystals

– L. Bata
Central Research Institute for Physics
H-1525 Budapest, P.O.B. 49
Hungary

Dielectric permittivity and relaxation phenomena in smectic phases

– Hatsuo Kimura
Department of Applied Physics
Faculty of Engineering, Nagoya University
Furo-cho, Chikusa-ku
Nagoya 464
Japan

Molecular theory of the frank elastic constants of liquid crystals

– J. N. Israelachvili
Applied Mathematics, IAS
Australian National University
Canberra
Australia

Force measurements to determine molecular ordering in thin liquid crystal films

– N. L. Sizova
Institute of Crystallography of the Academy of Science of the USSR
Leninskii Prospect 59
Moscow 117333
USSR

The use of CLC for the investigation of temperature increase in glide bands consisting of edge and screw dislocations in NaCl single crystals using the surface plasmon technique

– T. Hashimoto
Research Laboratory of Precision Machinery and Electronics
Tokyo Institute of Technology
Nagatsuta, Midori-ku
Yokohama, Kanagawa 227
Japan

Interference method with variable wavelength for the determination of refractive indices and birefringence of liquid crystals

– W. J. Benton
Mesolab
1046 Murray Hill Ave.
Pittsburgh, PA 15217
U.S.A.

Multi-banded dispersed cholesteric liquid crystal laminates

– G. Gottarelli
Instituto di Chimica degli Intermedi dell 'Universita'
Viale Risorgimento 4
40136 Bologna
Italy

Induction of cholesteric mesophases in nematic liquid crystals by some chiral aryl alkyl carbinols: a quantitative investigation

– T. Asada
Department of Polymer Chemistry, Kyoto Univ.
Yoshida Hon-cho, Sakyo-ku, Kyoto 606
Japan

Deformation and recovery of lyotropic cholesteric liquid crystals

– P. S. Pershan Department of Physics and Center for Materials Science and Engineering Massachusetts Institute of Technology Cambridge, MA 02139 U.S.A.	Order and disorder within the smectic-B phase of 40.8
– Philippe Martinot-Lagarde Laboratoire de Physique des Solides Universite Paris-Sud Bat. 510, Orsay France	Measurement of the permanent polarization amplitude and reorientation time in various ferroelectric smectic C compounds
– D. Demus Sektion Chemie Martin-Luther-Universitat Halle 402 Halle German Democratic Republic	Synthesis and properties of new liquid crystalline materials
– Barbara Grant IBM Research, K42/282 5600 Cottle Rd. San Jose, CA 95193 U.S.A.	Recent advances in the design of mesomorphic materials
– G. W. Gray Department of Chemistry University of Hull Hull, HU6 7RX U.K.	A comparative survey of the properties of liquid crystal materials containing benzene, cyclohexane and *bicyclo(2.2.2) octane rings*
– Mary E. Neubert *Liquid Crystal Institute* Kent State University Kent, OH 44242 U.S.A.	The effect of mesomorphic properties of substituting a sulfur for an oxygen atom in the ester linkage of 4-alkylphenyl-4`-alkyl or alkoxy-benzoates
– J. M. Lohar Applied Chemistry Department Faculty of Technology and Engineering M.S. University of Baroda Baroda, 390 001 India	Schiffs base homologous series of new mesogens: p-(p'-n-alkoxycinnamoyloxy) benzylidene-p"-N,N-dimethylaminoanilines and p-(p'-n-alkoxycinnamoyloxy) benzylidene-p"-N,N-diethyl-aminoanilines
– S. Takenaka Department of Applied Chemistry Faculty of Engineering Osaka University Yamada-ue, Suita, Osaka 565 Japan	Synthesis and mesomorphic properties of new liquid crystalline materials involving piperazine skeleton
– Liu Chu-tsin Shanghai Institute of Organic Chemistry Academia Sinica 345 Ling Lin Lu, Shanghai 200032 People's Republic of China	Molecular structure and phase transition of thermotropic liquid crystals

– L. Pohl E. Merck, Analytisches Zentrallaboratorium Frankfurter Strasse 250 D-6100 Darmstadt West Germany	A simple and reliable method for the evaluation of multicomponent eutectics
– G. W. Gray Department of Chemistry University of Hull Hull, HU6 7RX U.K.	The liquid crystal properties of 4-alkyl- and 4-alkoxyphenyl 4-alkylbicyclo(2.2.2)octane-1-carboxylates
– R. Eidenschink E. Merck Zentrallaboratorium Industriechemikalien und Analytisches Zentrallaboratorium Frankfurter Strasse 250 D-6100 Darmstadt West Germany	Nematic keto-enols, liquid crystalline complexing agents
– K. Toriyama Mobara Works, Hitachi Ltd. Mobara, Chiba 297 Japan	Chemical inspections on viscosity of nematic liquid crystals
– V. V. Titov Organic Intermediates & Dyes Institute 103787 Moscow USSR	New heterocyclic liquid crystalline compounds
– H. Gasparoux Centre de Recherche Paul Pascal Universite de Bordeaux I Domaine Universitaire 33405 Talence Cedex France	Carbonaceous mesophase and disc-like nematic liquid crystals
– Sugio Otani Faculty of Technology Gumma University Kiryu 5-1, Tenjin-cho, Kiryu Gumma 376 Japan	Carbonaceous mesophase and carbon fiber
– S. Chandrasekhar Raman Research Institute Bangalore 560006 India	Liquid crystals of disc-like molecules
– J. Billard Universite des Sciences et Techniques de Lille 59655 Villeneuve d'Ascq France	Orientation of discotic mesophases

– J. E. Zimmer
Acurex Corporation
485 Clyde Ave.
Mountain View, CA 94042
U.S.A.

Disclinations in a liquid crystal with platelike molecules

S. Zummer
Physics Department
University E. Kardelj of Ljubljana
61000 Ljubljana
Yugoslavia

Disc-like liquid crystals: molecular motions and nuclear magnetic relaxation

– A. Cemal Eringen
Princeton University
Princeton, NJ 08544
U.S.A.

Continuum theory of disk-like liquid crystals

– F. Simoni
Dipartimento di Fisica
Universita degli Studi di Calabria
Arcavacata di Rende-Cosenza
Italy

Optical behavior of a cholesteric liquid crystal under an electric field

– B. S. Scheuble
Fraunhofer-Institut fur Angewandte Festkorperphysik
Eckerstr. 4
D-7800 Freiburg
West Germany

Optical, dielectric and elastic properties of single components and mixtures of liquid crystalline materials belonging to seven different classes

– A. Miyaji
Department of Electronic Engineering
Faculty of Technology
Tokyo University of Agriculture and Technology
24-16, Naka-machi 2-chome
Koganei, Tokyo 184
Japan

Optical properties of 90° twisted nematic liquid crystal displays; estimate by colorimetry

– S. Matsumoto
Toshiba Research and Development Center
Toshiba Corporation
Komukai Toshiba-cho
Kawasaki-city 210
Japan

Effect of liquid crystal classes on the improvement of their dynamic scattering by electron donor-acceptor dopants

– A. C. Lowe
IBM Corporation
Research Division
5600 Cottle Road
San Jose, CA 95193
U.S.A.

Order parameter and performance of nematic guest-host displays

– J. Cognard
Asulab S. A., Chemistry Group
2001 Neuchatel
Switzerland

Dichroic dyes with good stability and high order parameter

– G. Scherowsky Institut fur Organische Chemie Technische Universitat Berlin Strasse des 17. Juni 135 D-1000 Berlin 12 West Germany	New dichroic anthraquinone dyes with high order parameters
– Y. Okita Shioya Laboratory Sanyo Electric Co. Ltd. 809-332, Higashitarumi-cho Takamaru, Tarumi-ku, Kobe Hyogo 655 Japan	Surface treatment and electro-optical properties of guest-host cell
– F. Matsukawa Products Development Laboratory Mitsubishi Electric Corporation 80, Minimi-shimizu Nakano Amagasaki, Hyogo 661 Japan	Improved temperature coefficient of threshold voltage in twisted nematic liquid crystals
– Masaaki Taguchi Daini-Seikosha Co., Ltd. 6-31-1 Kameido, Koto-ku Tokyo 136 Japan	Application of nematic-cholesteric phase transition to watch displays
– M. de Zwart Philips Research Laboratories Eindhoven The Netherlands	The 'Fingerprint' memory in cholesteric planar layers
– Noel A. Clark Department of Physics University of Colorado Boulder, CO 80302 U.S.A.	Spontaneous bistable smectic C monodomain formation and microsecond electro-optic switching in ferroelectric liquid crystals
– P. Andrew Penz Texas Instruments Inc. M/S 119 Dallas, TX 75265 U.S.A.	Phase retarder, reflective LCD
– Zhao Jing-An Liquid Crystal Physics Research Group Tsing Hua University Beijing People's Republic of China	Use of fast response of Ch-N transition on television
– G. J. Sprokel IBM Research Division San Jose, CA 95101 U.S.A.	Determination of the surface tilt angle by attenuated total reflection

– A. Hochbaum Department of Chemistry, Temple University Philadelphia, PA 19122 U.S.A.	Nematic-isotropic phase transition in sub-micron layers
– H. Mada Department of Electronic Engineering Faculty of Technology Tokyo University of Agriculture and Technology Koganei, Tokyo 184 Japan	Surface order parameter of 4-N-heptyl-4'-cyanobiphenyl
– Clive A. Croxton Department of Mathematics, University of Newcastle New South Wales 2308 Australia	Determination of a local order parameter at the surface of a nematic-isotropic liquid crystal
– M. Nakamura Hitachi Research Laboratory 4026 Ohmika, Kojicho Hitachi 319-12 Japan	Alignment of nematic liquid crystals on the ruled grating surfaces
– S. Naemura Central Research Laboratories Nippon Electric Co., Ltd. 4-1-1 Miyazaki, Takatsu-ku Kawasaki 213 Japan	Physicochemical study on liquid crystal-substrate interfacial interactions
– Aritada Hatta Laboratory of Interface Science of Metals Faculty of Engineering, Tohoku University Aramaki, Aoba Sendai 980 Japan	Infrared atr spectroscopy of liquid crystals
– H. Yamada Department of Physics, Faculty of Science Science University of Tokyo Kagurazaka, Tokyo 162 Japan	Relaxation of deformation in a nematic thin film with weak anchoring condition
– L. Q. Amaral Instituto de Fisica, Universidade de Sao Paulo C.P. 20516, Sao Paulo CEP 05508 Brazil	Study of orientational effects in a type II lyomesophase
Haruka Yamada Department of Chemistry Kwanseigakuin University 1-155, Uegahara 1-bancho Nishinomiya, Hyogo 662 Japan	The molecular alignment of nematic liquid crystals in thin films studied by Raman spectroscopy

- Denis Riviere
  Institut d'Optique Theorique et Appliques
  Bat. 503, Centre Universitaire d'Orsay
  B. P. N° 43-91406
  Orsay Cedex
  France

  Total internal reflection on nematic liquid crystals

- H. P. Hinov
  Institute of Solid State Physics
  Bulgarian Academy of Science
  Sofia 1113
  Bulgaria

  Penetration depth of surface forces into nematic layers

- A. G. Petrov
  Liquid Crystal Group
  Institute of Solid State Physics
  Bulgarian Academy of Science
  Sofia 1113
  Bulgaria

  Dynamics of the nonthreshold flexoelectric deformations of homeotropic nematic layers

- J. A. Castellano
  Stanford Resources, Inc., P.O. Box 20324
  San Jose, CA 95160
  U.S.A.

  Reliability and standards in the U.S.A.

- H. Ikeda
  The LCD Committee in Electronic Industries Association of Japan (EIA-J)
  3-2-2, Marunouchi, Chiyoda-ku
  Tokyo 100
  Japan

  Activities of the LCD committee in EIA-J

- Y. Kanuma
  Mobara Works, Hitachi Ltd., 3300, Hayano, Mobara
  Chiba 297
  Japan

  Reliability of liquid crystal display

- A. E. Stieb
  Fraunhofer-Institut fur Angewandte Festkorperphysik
  Eckerstr. 4, D-7800
  Freiburg
  West Germany

  A figure of merit for brightness and contrast and its application to various types of dichroic two level liquid crystal displays

- T. Shimomura
  Department of Visual Communication Design
  Kyushu Institute of Design
  226 Shiobaru, Minami-ku
  Fukuoka city 815
  Japan

  Criteria of color contrasts in liquid crystal display

- David M. Makow
  Division of Physics
  National Research Council of Canada
  Ottawa KIA OR6
  Canada

  Reflectance, transmittance and color gamut of superimposed layers of cholesteric liquid crystals

THE FIRST REGIONAL MEETING FOR BURN INJURIES IN JAPAN

Rudolph J. Marcus

The First Regional Meeting for Burn Injuries in Japan was held 19-20 June, 1980, in Sapporo, Japan. Although no one from ONR Tokyo was at this meeting, the abstracts of papers given at this meeting are available at this office and specific ones can be sent to those who request them.

The meeting emphasized two timely subjects, inhalation injuries and fluid therapy. Papers presented were:

– Basil A. Pruitt, Jr. U.S. Army Institute of Surgical Research BAMC, Fort Sam Houston, TX 78234 U.S.A.	Characteristics of inhalation injury
– Junji Hamamoto Department of Plastic and Reconstructive Surgery Hokkaido University School of Medicine Kita 15-jo Nishi 7-chome Kita-ku, Sapporo, Hokkaido 060 Japan	The study of 133Xe lung scan and the pathophysiological changes in inhalation injuries
– Joseph A. Moylan Duke University Medical Center Durham, NC 27706 U.S.A.	Inhalation injury–clinical experiences 1. (Findings & fluid therapy)
– Nobuo Nishimura Department of CCM Nippon Medical School 1-5, Sendagi 1-chome Bunkyo-ku, Tokyo 113 Japan	Inhalation injuries–clinical experiences (II) our experience and value of fiberoptic bronchoscopy
– Bruce G. MacMillan Shriners Burns Institute Cincinnati Unit Cincinnati, OH 45221 U.S.A.	Inhalation injuries–lung infection
– Tetsunori Yoshida Department of Plastic and Reconstructive Surgery School of Medicine Hokkaido University Kita 15-jo Nishi 7-chome Kita-ku, Sapporo, Hokkaido 060 Japan	Fluid therapy in Japan

– Charles R. Baxter
University of Texas Health Science Center at Dallas
Dallas, TX 75235
U.S.A.

Resuscitation of major thermal injury

– Gosta Arturson
Burn Center, University Hospital
S-750 14 Uppsala
Sweden

Fluid therapy in Sweden

– Toshiharu Yoshioka
Department of Traumatology
Osaka University School of Medicine
1-1, Fukushima, Fukushima-ku, Osaka 553
Japan

Intravenous fluid effect on hemodynamic chance and respiratory function in extensive thermal injury

– Naoki Aikawa
Department of Surgery
Saiseikai Kanagawaken Hospital (Yokohama), and
School of Medicine, Keio University
35, Shinano-machi, Shinjuku-ku, Tokyo 160
Japan

Individualized fluid replacement program and hemodynamic monitoring of burned patients

– Basil A. Pruitt, Jr.
U.S. Army Institute of Surgical Research
Fort Sam Houston, TX 78234
U.S.A.

Resuscitation fluid regimen: limitations and indications

– Michiyoshi Hayashi
Department of Plastic Surgery
Tokyo Womens Medical College
10, Ichigaya Kawada-cho
Shinjuku-ku, Tokyo 162
Japan

Our therapeutic direction of the hand with severe burn

– Hidetoshi Horiuchi
Department of Plastic Surgery
Nagasaki University Hospital
7-1 Sakamotomachi
Nagasaki 852
Japan

Lyophilized dermal porcine skin a laboratory evaluation

– Karo Maeda
Division of Plastic Surgery
Kanagawa Children's Medical Center
138, Mutsukawa 2-chome
Minami-ku, Yokohama
Kanagawa 232
Japan

Experimental and clinical studies of collagen sponge sheet as a biological dressing

– Ronald M. Sato
University of Texas Health Science Center
Department of Surgery
5323 Harry Hines Boulevard
Dallas, TX 75235
U.S.A.

Porcine zenograft preparations: light and scanning electron microscopic observations

T. Usuda
Department of Plastic and Reconstructive Surgery
Chukyo Hospital
Sanjo-cho 1-23, Minami-ku
Nagoya City 457
Japan

Antiepithelial antibodies in burned patients

John Bunyan
Private Research

Hypochlorous acid solutions in the prevention and control of infection in burns

Tetsunori Yoshida
Department of Plastic and Reconstructive Surgery
School of Medicine
Hokkaido University
Kita 15-jo Nishi 7-chome
Kita-ku, Sapporo
Hokkaido 060
Japan

Burn wound infection and systemic antibiotic therapy

Toshiko Akahane
Department of Plastic and Reconstructive Surgery
Kanazawa Medical University
1-1 Daigaku, Uchinada
Ishikawa 925-04
Japan

Electron microscopic observations on silver absorption of burn wounds treated with silver sulfadiazine cream

S. Sano
Division of Plastic and Reconstructive Surgery and Department of Hygiene
Faculty of Medicine
Kyoto University
Yoshida Hon-cho, Sakyo-ku
Kyoto 606
Japan

Absorption, excretion and tissue distribution of the silver sulfadiazine

Ryuzaburo Tanino
Department of Plastic Surgery
Tokai University School of Medicine
Boseidai-dai, Isehara
Kanagawa 259-11
Japan

Acute leucopenia induced by silver sulfadiazine

Ryosuke Fujimori
Department of Plastic Surgery
Faculty of Medicine, Kyoto University
Kawahara-cho, Shogoin
Sakyo-ku, Kyoto 602
Japan

Early scar plasticity as a cause of scar contracture

Takahiko Moriguchi
Hamamatsu City
Shizuoka 434
Japan

Mast cell analyses in hypertrophic scar and hypertrophic scar treated with triamcinolone acetonide injection

– Keisuke Fujita
Institute of Pharmacognosy and Department of Dermatology
School of Medicine
Fujita-Gakuen University
1-98, Kutsukake-cho
Dengaku-ga-kubo, Toyoake
Aichi 470-11
Japan

Effects of high molecular aloe components on thermal burns

– Saburo Kishimoto
Department of Dermatology
Kyoto Prefectural University of Medicine
465, Kawaracho-dori
Kirokoji-noboru Kajii-cho
Kamikyo-ku, Kyoto 602
Japan

The regeneration of nerves and blood vessels in third degree thermal burned skin of guinea pigs– histochemical and scanning electron microscopical study–

– Kohji Suzuki
Plastic Surgery, Chukyo Hospital
65, Tsuramai-cho
Showa-ku, Nagoya
Aichi 466
Japan

Partial purification of toxic substance on mitochondrial function extracted from burn skin

– Motohiro Nozaki
Department of Plastic Surgery
Tokyo Womens Medical College
10, Ichigaya Kawada-cho
Shinjuku-ku, Tokyo 162
Japan

Experimental pathological study of the thermal burn encephalopathy–with reference to the ultrastructural alternation of the blood-brain barrier

– M. Ohashi
Tokyo Denryoku Hospital
9-2, Shinano-machi
Shinjuku-ku, Tokyo 160
Japan

The lightning mark (clinical experience and experimental study)

– Yutaka Ogawa
Department of Plastic Surgery, Kyoto University
Yoshida Hon-cho
Sakyo-ku, Kyoto 606
Japan

Histological alteration of the pancreatic islet cell in the burned shock rats

– Masahide Ando
Department of Plastic and Reconstructive Surgery
Saku Central Hospital
Nakagomihara, Usuda
Nagano Prefecture 384-05
Japan

The changes of serum immunoglobulins in severe burns

– Shunji Ikeuchi
School of Medicine, Keio University
35, Shinano-machi, Shinjuku-ku, Tokyo 113
Japan

The effects of burn injury on tumor growth

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ONR TOKYO SCIENTIFIC BULLETIN. VOLUME 5, NUMBER 3, JULY-SEPTEMB--ETC(U)
SEP 80 R J MARCUS, M L MOORE

UNCLASSIFIED NL

– Tai-Kwun Lee
Department of Plastic and Reconstructive Surgery
Faculty of Medicine
Tokyo University
3-1, Hongo 3-chome
Bunkyo-ku, Tokyo 180
Japan

Electron microscopic study of thermal burn keloids: histochemical observations

– G. Arturson
Burn Center, University Hospital
Uppsala
Sweden

Neutrophil granulocyte functions in severely burned patients

– Hidejiro O'ya
Burn Unit, Kyoto 1st Red Cross Hospital
Department Plastic Surgery
Tokyo Metropolitan Police Hospital
10-41, Fujimi-cho 2-chome
Chiyoda-ku, Tokyo 102
Japan

Statistical studies on burned patients in Japan

– Hideki Nakanishi
Plastic and Reconstructive Surgery Unit
Tokyo Metropolitan Police Hospital
10-41, Fujimi-cho 2-chome
Chiyoda-ku, Tokyo 102
Japan

Severe electrical burn associated with disseminated intravascular coagulation (DIC) syndrome

– M. S. Khwaja
Ahmadu Bello University Hospital, Zaria
Nigeria

Epidemiology of burns in a rural African population

– Barr, P-O
Rosenlund Hospital
116 69 Stockholm
Sweden

Simplified warm air bed for burns

– Masahide Ando
Department of Plastic and Reconstructive Surgery
Saku Central Hospital
Nakagomihara, Usuda
Nagano Prefecture 384-05
Japan

Surgical repair of webbed contracture

– Kazuaki Sakata
Plastic and Reconstructive Surgery Unit
Tokyo Metropolitan Police Hospital
10-41, Fujimi-cho 2-chome
Chiyoda-ku, Tokyo 102
Japan

An application of the latissimus dorsi myocutaneous flap to the treatment of post-burn deformity

– Chito Sugimoto
Department of Plastic and Reconstructive Surgery
Keio University Hospital, 35 Shinanomachi
Shinjuku-ku, Tokyo 160
Japan

Microsurgical preparation of recipient bed for successful skin graft

– Teich-Alasia. S.
Department of Plastic Surgery and Burn Unit of the Traumatological Centre
Via Zuretti 29, Turin
Italy

Evaluation of the burned patient in relation to surgical treatment

– Nimsakul Narong
Department of Plastic Surgery School of Medicine
Tokai University
Bosei-dai, Isehara-shi
Kanagawa 259-11
Japan

Role of laser surgery in burn treatment

– H. Aoyama
Plastic Surgery, Chukyo Hospital
12, Nisshin-cho Iwasaki Araike
Aichi-gun, Aichi 470-01
Japan

The effect of skin grafting on burn wound– biochemical and histological aspects–

– G. Arturson
Burn Center, University Hospital
Uppsala
Sweden

The possible involvement of free radicals in acute edema formation after a mild thermal injury

– Nordstrom, H.
Burns Unit, University Hospital
581 85 Linkoping
Sweden

Hypermetabolism and plasma catecholamines in severe burns

– Ken Maemura
Department of Traumatology
Osaka University School of Medicine
1-1, Fukushima
Fukushima-ku, Osaka 553
Japan

Hepatic enzyme abnormalities following extensive thermal injury

– Nobuo Nishimura
Department of Critical Care Medicine
Nippon Medical School
1-5, Sendagi 1-chome
Bunkyo-ku, Tokyo 113
Japan

Changes of P_{50} and colloid osmotic pressure in burn injury

– Naoki Aikawa
Department of Surgery
Saiseikan Kanagawaken Hospital
6-6, Tomiya-cho, Kanagawa-ku
Yokohama 221
Japan

Alterations in cardiac function in the early postburn period

– J. Angelats
Loyola University
Stritch School of Medicine
Maywood, IL 60611
U.S.A.

Serum cadmium levels in burn patients; a possible significance in pulmonary injury

SIXTH INTERNATIONAL CONFERENCE ON LIQUEFIED NATURAL GAS

Rudolph J. Marcus

The Sixth International Conference of Liquefied Natural Gas was held in Kyoto, 7-10 April, 1980. Although no one from ONR Tokyo was at this meeting, the papers given at this meeting are available at this office and specific ones can be sent to those who request them.

The following subjects were discussed at the Conference:

- LNG and world energy supplies
- Developments in LNG technology
- LNG transport and handling
- Legal and financial aspects of LNG trade

The following papers were given at the conference:

- G. Kardaun
  N. V. Nederlanse Gasunie
  Groningen
  The Netherlands

  How LNG fits in Dutch gas planning

- Salah Bouchami
  Director of L.N.G. Operation
  Petrochemicals
  LNG and Refining Division
  Sonatrach-Arzew, Algeria

  International interrelationship opportunities growing out of the LNG trade

- Nobuyori Kodaira
  Deputy Director
  Development Division
  Petroleum Department
  Agency of Natural Resources and Energy
  Ministry of International Trade and Industry
  3, Kasumigaseki 1-chome
  Chiyoda-ku, Tokyo 100
  Japan

  Energy problems and measures taken to promote wider use of LNG in Japan

- Edward J. Daniels
  Manager
  Energy Systems Analysis
  Institute of Gas Technology
  Chicago, IL
  U.S.A.

  Energy alternatives to LNG

- George H. Lawrence
  President
  American Gas Association
  Arlington, VA 22209
  U.S.A.

  The role of liquefied natural gas in a worldwide gas energy option

– Graham H. Freeman
Project Engineer
Technical Studies Department
British Gas Corporation
London
U.K.

The relative roles of LNG and LPG in today's and tomorrow's energy market

– Malcolm W. H. Peebles
Director, Planning and Finance
Shell International Gas Ltd.
London
U.K.

World LNG trade: current status and prospects for growth

– W. W. Bodle
Director
Institute of Gas Technology
Chicago, IL
U.S.A.

Considerations for mercury in LNG operations

– Maurice Grenier
Directeur Technique
L'Air Liquide
Departement Constructions
57, Avenue Carnot
94500 Champigny S/Marne
France

New cycle for natural gas liquefaction using plate exchanges

– Michael A. Howard, B.S.
Director of Energy Engineering
Northern Natural Gas Company
Omaha, NE
U.S.A.

Northern Natural Gas Company's PRICO LNG process and storage plant located at Ventura, Iowa, U.S.A.

– J. M. Geist
Chief Engineer
Air Products and Chemicals, Inc.
Allentown, PA 18105
U.S.A.

Predicted and actual temperature profiles and pressure drops in large coil wound, mixed refrigerant heat exchanges

– John H. Parker
Senior Power Systems Engineer
General Electric Company
Export Sales & Service Division, NY
U.S.A.

Process driver systems for future LNG plants

– Jean Bourgin
Expert Machines Tournantes
Technip
Paris
France

Use of gas turbines in natural gas liquefaction plants

– Gunter Krey
Head of Gas Turbine Department
Gutehoffnungshutte Sterkrade AG
Oberhausen
West Germany

How to improve the economy of LNG terminals

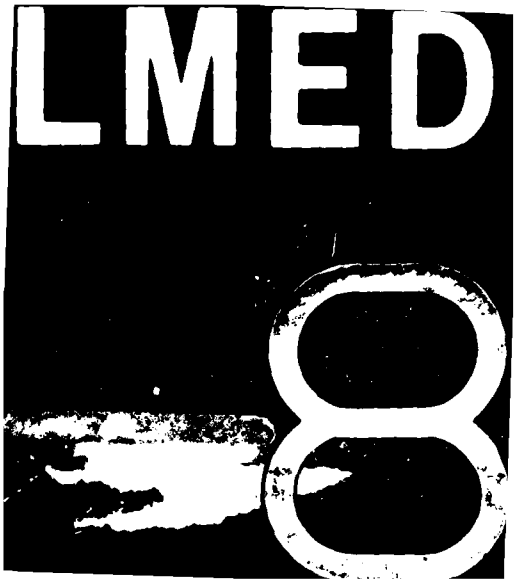
– Shigeetsu Miyahara Director Manager, Thermal Power Department The Tokyo Electric Power Co., Inc. 1-3, Uchisaiwai-cho 1-chome Chiyoda-ku, Tokyo 100 Japan	Power generation from cryogenic energy
– Tomitaka Yoshikawa Director, Engineering Department Osaka Gas Company Ltd. 5-1, Chiyozaki-cho 3-chome Nishi-ku, Osaka, Osaka 550 Japan	Developments in the commercial use of LNG cold
– Toshie Okumura Chairman of the Committee on LNG Inground Storage Faculty of Engineering Saitama University 255, Shimo-Ohkubo, Urawa Saitama 338 Japan	Recommended practice for LNG inground storage
– F. Sakai Steel Structure Division Plant Engineering Group Kawasaki Heavy Industries, Ltd. World Trade Center Bldg. 4-1, Hamamatsu-cho 2-chome Minato-ku, Tokyo 105 Japan	Studies on earthquake-resistance of liquefied natural gas storage tanks
– A. C. Timmers, Ir Shell Internationale Petroleum Maatschappij B.V. The Hague The Netherlands	Development of fire prevention measures for large LNG storage installations
– N. J. Cuperus Head, Civil Engineering Shell Internationale Petroleum Maatschappij B.V. The Hague The Netherlands	Developments in cryogenic storage tanks
– B. Coussy Chef du Groupe Gazier Mediterranee Gaz de France Paris France	Operating experience at the LNG terminal of FOS-S/MER
– Tetsuo Akiyama Manager of Sodegaura Works Tokyo Gas Co., Ltd. 1-1, Sodegaura-cho Nakasode Kimitsu-gun, Chiba 299-02 Japan	The recent scheme of LNG receiving terminals in Japan

– H. Mori Manager Plant Construction Division Engineering Department Tokyo Gas Co., Ltd. 16-25, Shibaura 1-chome Minato-ku, Tokyo 105 Japan	Technical improvements in LNG vaporizers for *receiving terminals in Japan*
– Michael Corkhill Editor Hazardous Cargo Bulletin London U.K.	LNG shipping: past, present and future directions
– B. Grison Gazocean Paris France	Fifteen years experience in operation of methane carriers
– J. J. Cuneo President Energy Transportation Corporation U.S.A.	Operating experience with LNG carriers applying the skirt supported, spherical cargo tank design
– Masayoshi Kurihara Researcher Fracture Engineering Section Technical Research Center Nippon Kokan K.K. 1, Minami-wataruda-cho 1-chome Kawasaki-ku, Kawasaki Kanagawa 210 Japan	Safety assessment on fatigue strength of membrane components in LNG storage tanks and LNG carriers
– Ryuichi Nagamoto Chief Coordinator Shipdesigning Departme Mitsubishi Heavy Industries, Ltd. 1-1, Akunoura-cho, Nagasaki Nagasaki 850-91 Japan	On the sloshing force of rectangular tank type LNG carriers
– Capt. Hans Peter Greuner Manager LNG Sea Transport Ruhrgas LNG Flussigerdgas Service GmbH Essen West Germany	Studies of the resistance of LNG carriers to collisions
– Dennis G. W. Allsop Executive Vice President Burmah Oil Shipping, Inc. 1270 Avenue of the Americas New York, NY 10020 U.S.A.	Transporting LNG from Indonesia to Japan

– M. Oshima Deputy Director Ship & Ocean Project Headquarters Mitsui Engineering & Shipping Co., Ltd. 6-4, Tsukiji 5-chome Chuoh-ku, Tokyo 104 Japan	Design and experiments of offshore LNG plant using prestressed concrete structures
– D. Meyer-Detring Manager, Offshore Development Preussag AG Erdoel und Erdgas Hannover West Germany	Development and model testing of a floating natural gas liquefaction plant
– Thomas M. Ehret Manager, New Product Development FMC Europe S.A. B.P. 91, Sens France	Offshore LNG and LPG transfer system
– E. W. Johnson Professor, Mechanical Engineering The University of Calgary Calgary, Alberta Canada	Some economic design parameters for cryogenic internally insulated natural gas pipelines
– Michael C. Parnarouskis U.S. Coast Guard Washington, D.C. U.S.A.	Vapor cloud explosion study
– F. Marle Head of Legal Department Gaz de France Paris France	The legal aspects peculiar to the sea transportation of liquefied natural gas
– Gerald B. Greenwald Partner Law Firm of Arent, Fox, Kintner, Plotkin, and Kahn Washington, D.C. U.S.A.	Where the sales contract and the transportation contract meet: vital clauses affecting LNG project participants
– Setsuo Matsuzawa Deputy Chief Ship Inspector Ship Bureau Ministry of Transport 1-3, Kasumigaseki 2-chome Chiyoda-ku, Tokyo 100 Japan	Laws and regulations of Japan on LNG carriers
Ragnar Belck-Olsen Assistant Director, Gas Department Leif Hoegh and Co. A/S, Oslo Norway	Financial and legal aspects of LNG trading considered important from a shipowner's viewpoint

– P. Takis Veliotis Executive Vice President Marine General Dynamics Corporation St. Louis, MO U.S.A.	Marketing LNG vessels to U.S. import project–the ship-builder's experiences and risks
– Ir. Soedarno Martosewojo Director of General Affairs Pertamina Indonesia	Total system coordination can produce a quality LNG project
– Tetsuo Iizuka Executive Director Japan National Oil Corporation Fukoku Seimei Bldg. 2-2, Uchisaiwai-cho 2-chome Chiyoda-ku, Tokyo 100 Japan	Financing of LNG plants
– Jean-Pierre Dufresne Director Gaz Naturel Technip Paris France	Energy savings in natural gas liquefaction plants
– D. M. Slavich Manager Project Financing and Investment Bechtel Co. U.S.A.	Financing LNG projects in a changing economic environment
– William A. Smith Gas Development Corporation 10 West 35th Street Chicago, IL U.S.A.	Reliability of base-load LNG delivery
– T. Miyakawa Technical staff Kitakyushu Liquefied Natural Gas Co., Inc. 46, Nakahara Sakinohama Tobata-ku, Kitakyushu Fukuoka 804 Japan	The stratification and mixing of LNG in storage tanks
– A. Salvadori de la Direction des Etudes et Techniques Nouvelles Gaz de France Paris France	Techniques anti-roll over
– M. W. McEwan Gas and LPG Treating Design Group Leader Shell Internationale Petroleum Maatschappij B.V. The Hague The Netherlands	Developments in LNG treating

– Richard F. Bukacek Senior Education Advisor Institute of Gas Technology Chicago, IL U.S.A.	Training for engineers in LNG plant operations
– Nguyen Van Tuyen New Technique Department Manager Omnium Technique des Transports par Pipelines Puteaux France	Long distance LNG pipelining technical and economic study
– Eginhard Berger Project Manager Natural Gas Plants *Linde AG, Werksgruppe TVT* Munich West Germany	Crucial parts of offshore LNG plants for the north sea
– George Gibson 181 Summit Avenue Upper Montclair, NJ 07043 U.S.A.	The increasing cost of LNG (causes and remedies)
– M. Francis Dewerdt Chef du Service Physique Appliquee Gaz de France Paris France	Assessment of densimeters and LNG sampler
– Sen-ichi Shamoto Deputy General Manager Fuel 2nd Dept. Nissho-Iwai Co., Ltd. 4-5, Akasaka 2-chome Minato-ku, Tokyo 107 Japan	Overcoming financial, legal, and company-policy restrictions in the importation of LNG to Japan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